DRAFT FINAL
EXPANDED ENGINEERING EVALUATION/COST ANALYSIS
FOR THE
STIMSON LUMBER COMPANY COOLING POND

Missoula County, Montana

Prepared For:

Montana Department of Environmental Quality
P.O. Box 200901
Helena, Montana 59620-0701

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EXECUTIVE SUMMARY

Olympus Technical Services, Inc. (Olympus) has prepared this Engineering Evaluation and Cost Analysis (EE/CA) for the remediation of the cooling pond and associated berm located at the Stimson Lumber Company Mill (Site) in Bonner, Montana. This EE/CA was prepared for the Montana Department of Environmental Quality (DEQ) under DEQ Contracts Nos. 401026-TO17 and 407037-TO2.

The Site is located in the city of Bonner, Missoula County, Montana, within Section 22, Township 13 North, Range 18 West, Montana Principal Meridian at Latitude 46° 52’ 34” North, Longitude 113° 52’ 00” West. The Stimson Bonner Mill is a sawmill and plywood manufacturing facility. The cooling pond collects water from various sources at the Stimson Bonner Mill including boiler blow down water, yard runoff, and Non Contact Cooling Water (NCCW). At capacity, the pond has approximate dimensions of 485 feet long by 68 feet wide with a surface area of approximately 32,100 square feet. The depth of water is variable, ranging from less than one foot at the western edge of the pond to approximately nine feet in the eastern end of the pond at capacity. Water from the pond normally discharges to the Blackfoot River from an outlet located in the eastern area of the pond. However, during the October 2006 sediment sampling, the surface elevation of the pond was approximately 3.75 feet lower than the pipe outlet. The lower water level in the cooling pond occurred after the Bonner Dam had been removed and the water level in the Blackfoot River had been lowered. In October 2006, the cooling pond had approximate dimensions of 350 feet long by 55 feet wide with a surface area of approximately 18,000 square feet. The depth of water was variable, ranging from less than one foot at the western end of the cooling pond to approximately 4.5 feet in the eastern portion of the cooling pond.

Field Sampling, Laboratory Analytical, and Quality Assurance Project Plans were prepared for the site in March and October 2006 (Olympus, 2006a and 2006c). These documents outline the sampling and analytical methods used to generate the site characterization database. The site characterization work was performed during March, October, and November 2006. A Site Characterization Report (Olympus, 2006b) presented the results of the March investigation and the October and November investigation results are presented in this EE/CA. A geotechnical characterization report (Olympus, 2007) presented the results of the physical characterization of the cooling pond berm, pond sediment, and volume estimates.

Olympus reviewed contact prints of historical aerial photographs of the Stimson Mill area obtained from the Montana Department of Transportation archives. The aerial photographs were acquired by MDT on October 10, 1956; May 20, 1963; November 1, 1965; and June 28, 1978. The photographs show that the pond was in use by 1956 and the berm appeared to be constructed of wood cribbing placed on the Blackfoot River stream bed. The pond appears to have been used for log storage prior to its use as a cooling pond. The pond has been partially filled over time and riprap material placed over portions of the wood cribs. The cribs were further stabilized in April 2007 when the US Army Corps of Engineers placed approximately 2,500 cubic yards of riprap along the outside of the exposed wood crib walls. This effort was completed to help stabilize the toe of the cooling pond berm against a 10-year high-flow event; however, the pond could be overtopped or compromised during a 100-year flood event. The US Environmental Protection Agency (EPA) and DEQ have determined that a potential cooling pond berm failure due to a high flow event presents an unacceptable risk to human health and the environment.

Stimson Lumber Company has conducted various phases of environmental investigation and remediation of historical hydraulic oil releases in the vicinity of the Cooling Pond. A release of hydraulic oil was detected at the Stimson Lumber Company historical fire pond lagoon, located immediately west of the cooling pond, in August of 2002 when water levels in the Blackfoot River were lowered approximately five feet during drawdown on the Milltown Reservoir (PBS&J, 2007). Approximately 1,180 cubic yards of hydrocarbon-impacted soil were removed from the Fire Pond Lagoon area (Figure 10) over the period from September through December 2004. The soil was disposed of at the BFI sanitary landfill in Missoula, Montana. Confirmation soil samples collected from the excavation indicated that hydrocarbon impacts remained in subsurface soil following the removal. Soil removed from this area was reportedly not tested for PCBs.

The Stimson Lumber Company removed approximately 26 cubic yards of hydrocarbon-impacted soil from the East Log Track area in June 2006. The East Log Track area, which is located on the south bank of the cooling pond, was identified as a hydraulic leak beneath the log processing track. A worst-case sample of the excavated soil was analyzed for extractable petroleum hydrocarbons (EPH) and it contained an EPH concentration of 573,000 milligrams/kilogram (mg/kg). The soil was disposed of at the Allied Waste sanitary landfill (f/k/a BFI) in Missoula, Montana. Confirmation soil samples collected from the excavation indicated that hydrocarbon impacts remained following the removal. The confirmation soil sample with the highest EPH concentration (10,000 mg/kg) was also analyzed for PCBs and it contained a PCB concentration of 30 mg/kg.

The Stimson Lumber Company conducted several phases of subsurface soil and ground water investigation between 2004 and 2007 in the Fire Pond Lagoon and East Log Track areas. The investigations focused on petroleum hydrocarbons and no samples were analyzed for PCBs. The investigations identified concentrations of EPH fractions in subsurface soil that exceed DEQ risk-based screening levels (RBSLs) at both locations. Hydrocarbon impacts to ground water were observed in the Fire Pond Lagoon area but not the East Log Track area (Figure 10), both as non-aqueous phase liquid (NAPL) floating on the ground water surface and dissolved in the water. One ground water sample has been collected from a well (MW-6) located near the East Log Track area release and elevated concentrations of EPH were not detected in that sample.

Both the Fire Pond Lagoon and East Track areas are listed as active DEQ release sites and additional investigation and corrective action are planned. The Stimson Lumber Company has proposed installing additional monitoring wells and conducting periodic ground water monitoring to assess the impacts from continued drawdown of the Blackfoot River as the Milltown Dam is removed.

Site characterization was conducted for this EE/CA to evaluate the chemical and physical characteristics of the pond sediment and berm fill material. Olympus completed the Site characterization in two phases. The first phase occurred in the Spring of 2006 at which time four borings were completed into the pond sediment. Samples collected from the borings were analyzed for a broad range of organic and inorganic compounds since the types of historical discharges to the cooling pond were unknown. The target analyte groups for the first phase of the investigation included pH, Eh, total metals, volatile petroleum hydrocarbons (VPH), EPH, volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), herbicides, and pesticides. Selected samples were also analyzed for hazardous waste characteristics using the toxic characteristic leaching procedure (TCLP). The samples were analyzed by Northern Analytical Laboratories located in Billings, Montana. The investigation identified the presence of elevated concentrations of petroleum hydrocarbons and polychlorinated biphenyls (PCBs) in the pond sediment.

A second investigation phase of pond sediment and berm fill material quality was conducted in the Fall of 2006 to further assess the distribution of elevated concentrations of petroleum hydrocarbons and PCBs in the pond sediment and berm fill material as well as Site ground water. The samples were analyzed by the US Environmental Protection Agency (EPA) Region 8 Technical and Management Services Analytical Laboratory located in Golden, Colorado. The Fall 2006 investigation was also expanded to include the assessment of surface water in the pond and sediment in the Blackfoot River.

The principal techniques used for data acquisition in the site investigations were topographic mapping from aerial photographs, collection of subsurface soil samples from 23 borings advanced with hand augers and core and sonic drill rigs, installation of monitoring wells in three borings, measurement of static water levels in the monitoring wells, collection of ground water samples from the monitoring wells, collection of surface water samples from the pond, measurement of aquifer hydraulic conductivity through slug testing, and collection of surface sediment samples from the Blackfoot River.

Screening levels were used to evaluate soil, sediment, and water quality relative to potential health threats associated with uncontrolled disposal of the material. The screening levels are not to be considered as cleanup goals, but as concentrations at which further consideration is necessary. Screening levels for PCBs, C11-C22 range aromatic hydrocarbons, C19-C36 range aliphatic hydrocarbons, and manganese were exceeded in Site media samples and these constituents are identified as the contaminants of concern (CoCs) for the Site.

Pond sediment and berm fill material samples collected from the western two-thirds of the Site contained CoCs at concentrations above Site screening levels. The exceedances occur in an intermittent, unpredictable pattern from the ground surface to the depth of native alluvial sediments (up to 22 feet below the pond surface and 20 feet below the berm ground surface). PCBs are the most widespread CoC at the Site and the screening levels for PCBs were exceeded in every sample for which another COC screening level was exceeded. Overburden and sediment located in the western two-thirds of the Site is considered impacted, while overburden and sediment located in the eastern one-third of the Site is considered non-impacted. Although some sediment and overburden samples collected from the western two-thirds of the Site did not contain elevated concentrations of CoCs, all of that material will be treated as impacted since the distribution of CoCs is intermittent and cannot be verified by visual observation. Sorting non-impacted material from impacted material is not considered feasible. Six material types were identified at the Site and the breakdown is as follows:

Material Type	Volume (Cubic Yards)		
	Impacted Material	Non-Impacted Material	Total
Overburden	32,300	12,800	45,100
Cooling Pond Sediment	31,800	0	31,800
Other Berm Fill	16,900	11,400	28,300
Buried Logs/Wood Debris	4,000	0	4,000
Total Cooling Pond/Berm Fill	85,000	24,200	109,200
Surface Wood Debris	0	8,500	8,500
Total Material	85,000	32,700	117,700

Surface water samples were collected from the cooling pond and screening levels were not exceeded in these samples. Sediment samples were collected from the Blackfoot River at an upstream location, at the constructed pond outfall, and at the location where a seep discharges pond water into the Blackoot River. The only Blackfoot River sediment sample that contained measurable concentrations of target compounds was the seep sample, which contained a concentration of PCBs that was below the screening level.

Ground water was observed in two aquifers at the Site. There is a widespread unconfined aquifer that occurs in the native alluvium and berm fill material that is in hydraulic communication with both the cooling pond and the Blackfoot River. The aquifer appears to be recharged by both the cooling pond and the Blackfoot River, with regional ground water flow to the south and localized mounding under the cooling pond. Two monitoring wells were installed in this aquifer and ground water samples collected from one of the monitoring wells contained PCBs at concentrations that exceeded Site screening levels. There is also an unconfined, perched aquifer that occurs where permeable fill material overlies relatively impermeable fill and pond sediment beneath the berm embankment near the pond. The perched aquifer appears to be primarily recharged by the pond and would likely cease to exist if the pond were drained. A monitoring well completed in the perched aquifer did not produce adequate water for sample collection.

The primary objective of remediation in the project area is to protect human health and the environment in accordance with the guidelines set forth by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the National Contingency Plan (NCP) (EPA, 1990), as well as applicable State law, including the Comprehensive Environmental Cleanup and Responsibility Act (CECRA). Specifically, the remedial action objectives are: 1) to eliminate potential human health risk and environmental exposure to the CoCs in solid media (impacted cooling pond berm fill, impacted cooling pond sediment, and impacted logs and wood debris) at the Site, 2) to eliminate the adverse impacts of the CoCs on the local water resources; and 3) to eliminate the threats posed to human health and the environment by the potential failure of the cooling pond berm.

Remedial alternatives were evaluated in a multi-step process in which treatment technologies, general response actions and remediation technologies, and remediation alternatives were evaluated and either retained or eliminated based on a set of evaluation criteria. Each subsequent step in the screening process provides a more rigorous evaluation of retained options.

Seven remediation alternatives were selected for evaluation as listed below.

Alternative 1: No Action;

Alternative 2: Institutional Controls;

Alternative 3: Dry Excavation with Ex Situ Dehalogenation;

Alternative 4: Dry Excavation with Ex Situ High Temperature Thermal Desorption;

Alternative 5: Dry Excavation with On Site Disposal in a Modified RCRA Repository;

Alternative 6: Dry Excavation with Off Site Disposal Primarily at a Solid Waste Landfill; and

Alternative 7: Dry Excavation with Off Site Disposal at a TSCA Landfill.

Alternatives 1 and 2 did not meet remedial action objectives. Alternative 1 was retained for further evaluation as suggested by the NCP, but Alternative 2 was rejected. Alternatives 3, 4, and 7 were rejected because a similar degree of effectiveness could be obtained by other alternatives at lesser costs.

Alternatives 5 and 6 were retained for a detailed comparison. Alternative 1 was retained to provide a baseline comparison. Alternatives 5 and 6 both utilize excavation and removal of impacted materials from the Blackfoot River corridor. Excavation would advance to up to 12 feet below the November 2006 Blackfoot River level, requiring temporary diversion of the river during removal. The cost estimate for these remedial alternatives assumes that the cooling pond would be taken out of service far enough in advance of remediation that it would be able to drain passively and dewatering would only be required for sediments located beneath the water surface of the regional alluvial aquifer. Excavation would occur at up to seven feet into the unconfined regional aquifer. Both alternatives assume that the surface wood waste would be relocated to the Stimson Log yard at no cost. Both alternatives assume that non-impacted fill material in the Blackfoot River corridor would be used to backfill the excavation and provide a reasonable grade for river restoration purposes. The main difference between Alternatives 5 and 6 is the disposal method. Alternative 5 provides for disposal of impacted material in a repository to be constructed at the Stimson Bonner Mill while Alternative 6 provides for disposal of 84,790 cubic yards of impacted material in a solid waste landfill and 210 cubic yards of higher-PCB concentration impacted material in a Toxic Substances and Control Act (TSCA) landfill. The total present worth cost for Alternative 5 is estimated at $6,043,963, although this estimate does not include costs for acquisition of the repository property or opportunity costs associated with land use restrictions related to the repository. The total present worth cost for Alternative 6 is estimated at $6,940,493.

Based on the conclusions of the detailed analysis and comparative analysis of alternatives, Alternative 6: Dry Excavation with Off Site Disposal Primarily at a Solid Waste Landfill is proposed as the preferred alternative for remediation of the Site. This alternative is considered the most appropriate and cost-effective means to reduce risk to human health and the environment to an acceptable level.

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1.0 INTRODUCTION

Olympus Technical Services, Inc. (Olympus) has prepared this Engineering Evaluation and Cost Analysis (EE/CA) for the Montana Department of Environmental Quality (DEQ) under DEQ Contracts Nos. 401026-TO17 and 407037-TO2. This document presents the Engineering Evaluation and associated Cost Analysis (EE/CA) for the remediation of the cooling pond and associated berm located at the Stimson Lumber Company Mill (Site) in Bonner, Montana.

The Site is located in the city of Bonner, Missoula County, Montana, within Section 22, Township 13 North, Range 18 West, Montana Principal Meridian at Latitude 46° 52’ 34” North, Longitude 113° 52’ 00” West, as shown on Figure 1. An aerial photograph (NRIS, 2005) showing Site features is provided on Figure 2. The Stimson Bonner Mill is a sawmill and plywood manufacturing facility. The cooling pond collects water from various sources at the Stimson Bonner Mill including boiler blow down water, yard runoff, and Non Contact Cooling Water (NCCW). At capacity, the pond has approximate dimensions of 485 feet long by 68 feet wide with a surface area of approximately 32,100 square feet. The depth of water is variable, ranging from less than one foot at the western edge of the pond to approximately nine feet in the eastern end of the pond at capacity. Water from the pond normally discharges to the Blackfoot River from an outlet located in the eastern area of the pond. However, during the October 2006 sediment sampling, the surface elevation of the pond was approximately 3.75 feet lower than the pipe outlet. The lower water level in the cooling pond occurred after the Bonner Dam had been removed and the water level in the Blackfoot River had been lowered. In October 2006, the cooling pond had approximate dimensions of 350 feet long by 55 feet wide with a surface area of approximately 18,000 square feet. The depth of water was variable, ranging from less than one foot at the western end of the cooling pond to approximately 4.5 feet in the eastern portion of the cooling pond. Stimson Lumber may need to develop an alternative process or location for the discharge of cooling pond waters and coordinate this effort through the DEQ permitting office.

Field Sampling, Laboratory Analytical, and Quality Assurance Project Plans were prepared for the site in March and October 2006 (Olympus, 2006a and 2006c). These documents outline the sampling and analytical methods used to generate the site characterization database. The site characterization work was performed during March, October, and November 2006. A Site Characterization Report (Olympus, 2006b) presented the results of the March investigation and the October and November investigation results are presented in this EE/CA. A geotechnical characterization report (Olympus, 2007) presented the results of the physical characterization of the cooling pond berm, pond sediment, and volume estimates.

The EE/CA report is organized into 10 sections. The contents of each section are briefly described below and on the following pages:

SECTION 2.0 BACKGROUND - presents a background description of the Stimson Cooling Pond project’s significant site features including: a history of past development activities; geologic, hydrologic, and climatic characteristics of the site; and the cultural setting issues, such as present and future land uses.

SECTION 3.0 SITE CHARACTERIZATION SUMMARY - presents the results of the Site characterization. It describes the characteristics of the wastes present at the site, including types, volumes, and target analyte concentrations. The impact to ground water, surface water and stream sediments are also described in this section.

SECTION 4.0 SUMMARY OF THE APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS - presents the Federal and State government requirements which are considered applicable or relevant and appropriate (ARAR) for the remediation effort. Requirements discussed in this section are chemical-, location-, and action-specific ARARs. The Milltown Reservoir Sediments Operable Unit Record of Decision was also reviewed and referenced in this section.

SECTION 5.0 REMEDIAL ACTION OBJECTIVES AND PRELIMINARY REMEDIATION GOALS - presents the remedial action objectives and applicable clean-up standards. Where appropriate, these objectives specify contaminants of concern (CoCs), affected media, exposure pathways, and preliminary remediation goals (PRGs) for each environmental medium. PRGs are numerical values based on identified chemical-specific ARARs. PRGs are developed based on both ARARs and risk-based screening levels.

SECTION 6.0 DEVELOPMENT AND SCREENING OF REMEDIATION ALTERNATIVES - identifies and screens potentially applicable remediation alternatives. Remediation alternatives are evaluated based on effectiveness, implementability, and cost.

SECTION 7.0 DETAILED ANALYSIS OF REMEDIATION ALTERNATIVES - presents a detailed analysis and comparison of the final screened alternatives against the National Contingency Plan (NCP - EPA, 1990) evaluation criteria. This includes a qualitative evaluation of threshold criteria, and how each alternative will mitigate risk from the contamination and comply with ARARs.

SECTION 8.0 COMPARATIVE ANALYSIS OF REMEDIATION ALTERNATIVES - compares the remediation alternatives for consistency with ARAR requirements and develops the design approach for the final remediation of the site.

SECTION 9.0 PREFERRED ALTERNATIVE - proposes a preferred remediation alternative for the final remediation activities at the site.

SECTION 10.0 REFERENCES - lists the references cited in the text.

2.0 BACKGROUND

Background information for the Site is summarized in the following sections.

- Development History
- Climate
- Location and Topography
- Surface Water Hydrology
- Geology
- Hydrogeology
- Land Use and Population
- Potential Contaminant Sources

2.1 Development History

Information regarding development of the Site was obtained from past and current Stimson employees. The employees reported that the pond was built sometime after 1905 and before 1940. They reported that the pond used to be periodically dredged, and that the practice of placing logs in the pond prior to debarking continued into the early 1970s.

A comparison of historical and more recent photographs indicates that the pond embankment was built on the historical Blackfoot River bed as shown on Figures 3 and 4. Timber crib structures (cribs) were constructed in the river for sawmill operations as shown on the historical photograph on Figure 3.

Olympus obtained contact prints of historical aerial photographs of the Stimson Mill area from the Montana Department of Transportation archives. The aerial photographs were acquired by MDT on October 10, 1956; May 20, 1963; November 1, 1965; and June 28, 1978. Each aerial photograph was scanned, imported into AutoCAD, and rotated and scaled to match corresponding features on the topographic survey map and current aerial photos obtained from NRIS (2005).

Evaluation of historical aerial photographs is controlled by aerial photograph scale and quality. A review of the historical aerial photographs shows significant changes in the pond shape, construction, and apparent usage in the past 50 years. The 1956 aerial photograph is shown on Figure 5. In 1956, the pond area was apparently used for log storage and/or for soaking prior to debarking. The northern boundary of the pond was narrow and linear and appears to be constructed as a retaining wall similar to the wood cribbing that is visible in portions of the existing pond berm (Photographs 1, 2 and 3). Booms of logs are visible in the Blackfoot River immediately upstream of the Site and appear to be anchored to rock-filled wood cribs constructed in the river. The sawmill intake appears to be located at the western end of the pond. The southern boundary of the pond also appears to be a retaining wall of unknown construction type. Remnants of vertical wood walls are visible in photographs of the cooling pond (Photograph 4). The dimensions of the pond were approximately 850 feet long by 60 to 90 feet wide in the 1956 photograph.

The 1963 aerial photograph is shown on Figure 6. In the 1963 photograph, approximately the eastern half of the pond has apparently been filled. The western half of the pond was of similar construction as in the 1956 photograph with the wood-crib retaining wall along the northern perimeter; however, a portion of the southern perimeter of the pond had been expanded to the south. The southern perimeter of the pond appears to be constructed with a vertical retaining wall. Logs were present in the pond. The dimensions of the pond were approximately 430 feet long by 90 to 120 feet wide.

The 1965 aerial photograph is shown on Figure 7. In the 1965 aerial photograph, the size and shape of the pond are similar to the 1963 aerial photograph. The 1965 photograph indicates a well-traveled haul road from the log yard to the pond. The haul road extended over the filled portion of the pond that was visible in the 1963 photograph. Activities in the 1965 photograph indicate that the eastern portion of the pond had been filled to allow logs to be transported from the log yard, located southeast of the pond, placed in the pond and floated to the mill intake located at the western end of the pond. The dimensions of the pond were approximately 430 feet long by 90 to 120 feet wide.

The 1978 aerial photograph is shown on Figure 8. In the 1978 aerial photograph, the northern and western perimeter of the pond appears to have been reconstructed with an earthen fill, similar to the current configuration (Photograph 5). Some of the fill that was placed in the eastern portion of the pond appears to have been removed to extend the pond to the east by approximately 110 feet. A portion of the southern perimeter of the pond appears to have been filled; however, the southern perimeter of the pond still appears to have been a vertical retaining wall. The dimensions of the pond were approximately 540 feet long by 60 to 100 feet wide.

Based on the observation of the retaining wall in the 1956, 1963 and 1965 aerial photographs and field observations of wood cribbing in the existing berm (Photographs 1, 2 and 3), it appears that the existing berm was constructed over the wood-crib retaining wall.

In late November 2005, the old Bonner Dam adjacent to the Stimson Mill was removed in a joint effort by the USFWS, EPA, the State of Montana, BP-ARCO, and Stimson Lumber. The contractor that performed the removal was Envirocon, Inc. of Missoula. The dam was removed to the streambed elevation of the river at that time.

In October 2006, the State of Montana removed about 2,000 exposed logs adjacent to and on the streambed of the Blackfoot River immediately upstream of the old Bonner Dam site. The logs had been exposed after the Bonner Dam was removed and the Milltown Dam Stage 1 Drawdown of 10 feet was started in June 2006. The logs may have posed an operational threat to the Milltown Dam if they would have washed down stream during the next high-flow event.

In April 2007, EPA directed the USACE to place an additional 2,500 cubic yards of riprap along the outside of the exposed wooden walls contained within the cooling pond berm. This effort was completed to help stabilize the toe of the cooling pond berm against a 10-year high-flow event; however, the pond could be overtopped or compromised during a 100-year flood event. EPA and DEQ have determined that a potential cooling pond berm failure due to a high flow event, presents an unacceptable risk to human health and the environment.

2.2 Climate

There is no official weather station in Bonner, Montana. The nearest official weather station to the Site is located in Missoula, Montana. The National Oceanic and Atmospheric Administration (NOAA) has compiled temperature and precipitation data at Missoula, Montana for the periods 1893 through 2003 (NOAA, 2007). The average annual temperature recorded was 44.7 degrees Fahrenheit (°F). The lowest recorded temperature was -33 °F on January 26, 1957, and the highest recorded temperature was 105 °F, which has occurred 5 times. The average annual total precipitation for Missoula is 13.65 inches. Average annual total snowfall is 41.4 inches.

2.3 Location and Topography

The Mill is located in the Blackfoot River valley in the NW1/4, Section 22, Township 13 North, Range 18 West of the Montana Principal Meridian at Latitude 46° 52' 34" North, Longitude 113° 52' 00" West. Regional geography is characterized by steep mountainous terrain with vertical relief of up to 3,000 feet. The cooling pond is located on a bench above the south bank of the Blackfoot River at an elevation of approximately 3,270 feet above mean sea level. An approximate 25-foot wide embankment with an access road at its top separates the pond from the Blackfoot River. The pond surface is located approximately 3 to 6 feet below the top of the embankment at the elevation of the outlet, and the surface water level of the Blackfoot River was located approximately 18 to 20 feet below the top of the embankment in November 2006. A topographic map of the Site area is shown on Figure 1 and Figure 2 shows an aerial photograph of the Site and nearby features.

2.4 Surface Water Hydrology

The Blackfoot River drains an area of approximately 2,290 square miles upstream from the Site. The Site is located approximately 5,580 feet upstream (east) of the Blackfoot River's confluence with the Clark Fork River. The USGS Bonner gaging station on the Blackfoot River is located approximately 5.5 miles upstream of the Site. Stream flow records at the gaging station for the periods 1899 to 1905 and 1940 to 2006 show that flows have ranged from approximately 200 to 19,200 cubic feet per second.

2.5 Geology

The geology in the region has been summarized on a USGS geologic map (Lewis, 1998). The area is characterized by folded and faulted sedimentary rocks of Pre-Cambrian age. The structures are related to Sevier style thrust faults that trend northwest-southeast. The McNamara Formation, Bonner Quartzite, Mount Shields Formation, and Shepard Formation of the Belt Supergroup form the local bedrock at the Site. These formations are composed of interbedded argillite, siltite, and quartzite. The bedrock is exposed on the north bank of the Blackfoot River north from the Site. Quaternary age alluvial sediments and anthropogenic fill overlie the bedrock at the Site.

2.6 Hydrogeology

Information regarding hydrogeology in the vicinity of the Site was obtained from the Montana Bureau of Mines and Geology (MBMG) Ground Water Information Center (GWIC). There are 183 GWIC registered wells located within a one mile radius of the Site. The nearest registered wells and their reported total depth and static water level are shown on Figure 9; however, the well locations provided by GWIC are approximate, have not been confirmed, and some locations appear to be inaccurate.

GWIC provided drilling logs for some of the wells located within a one mile radius of the Site; available logs are provided in Appendix A and they indicate that the wells are completed in alluvial clay, sand and gravel. The maximum total depth of the wells located within one mile of the Site is reported to be 240 feet below ground surface (BGS), and the median total depth of the wells is reported to be 95 feet BGS. The maximum depth to static water level of the wells is reported to be 118 feet BGS, and the median depth to static water level of the wells is reported to be 48 feet BGS. The minimum total depth and minimum depth to static water levels of the wells was reported as zero; however, if no data are available the MBMG reports the minimum depths as zero; thus, the minimum depth data are unreliable.

Ground water quality data for a ground water sample collected from one of the Stimson Lumber Company wells was obtained from GWIC. The sample was collected on November 14, 2000, by MBMG staff and analyzed for major ions, trace elements, and basic water quality parameters. The analytical data for the ground water sample were compared to federal and state drinking water quality standards. Concentrations of analytes and other water quality parameters were detected at concentrations or levels below applicable water quality standards. Appendix A includes a copy of the ground water quality data obtained from GWIC.

2.7 Land Use and Population

Surrounding land is used for commercial and residential purposes. The Stimson Lumber Company Bonner Mill, consisting of warehouses, buildings, and log and chip storage areas, is located south, east, and west of the Site. The nearest residences are located adjacent to Montana Highway 200, approximately 1,000 feet southeast of the Site. Approximately 61,000 people live within a 20-mile radius of the Site.

2.8 Previous Site Environmental Investigations

Stimson Lumber Company has conducted various phases of environmental investigation and remediation of historical hydraulic oil releases in the vicinity of the Cooling Pond. The previous environmental investigation history described in this section was obtained from a report (PBS&J, 2007) prepared by PBS&J, who is Stimson Lumber Company's consultant providing investigation and remediation of hydraulic oil releases in the vicinity of an historical Fire Pond Lagoon. The Fire Pond Lagoon was located to the west of the Cooling Pond (Figure 10).

A release of hydraulic oil was detected at the Stimson Lumber Company historical fire pond lagoon in August of 2002 when water levels in the Blackfoot River were lowered approximately five feet during drawdown on the Milltown Reservoir (PBS&J, 2007). The lowering of water levels exposed sediments in the bottom of the Fire Pond Lagoon. A petroleum sheen was observed in the standing water of the lagoon and the release was reported to the DEQ and Missoula City-County Health Department. Stimson Lumber Company placed petroleum absorbent booms on entry-exit points to the lagoon and along the banks and in the standing water of the lagoon.

A subsurface investigation was completed in August 2002 to assess the source of the petroleum hydrocarbon sheen on the lagoon. The hydrocarbons were identified as lubricating oil and the source appeared to be from subsurface soil located south and east of the Fire Pond Lagoon. Remedial actions completed in August and September 2003 included completion of nineteen direct-push borings, four ground water monitoring wells, and construction of a river stage monitoring gauge. Hydrocarbon impacted soil was located directly south of the Fire Pond Lagoon and appeared to be related to the operation of hydraulic pumping units on the overhead log conveyor system. These pumping units have reportedly not been used during Stimson Lumber Company's operation of the mill (1993 to present). Ground water impacts appeared to be localized near the hydraulic unit.

Approximately 1,180 cubic yards of hydrocarbon-impacted soil were removed from the Fire Pond Lagoon area (Figure 10) over the period from September through December 2004. The soil was disposed of at the BFI sanitary landfill in Missoula, Montana. Confirmation soil samples collected from the excavation indicated that hydrocarbon impacts remained in subsurface soil following the removal. Soil removed from this area was reportedly not tested for PCBs.

Approximately 26 cubic yards of hydrocarbon-impacted soil were removed from the East Log Track area in June 2006. The East Log Track area, which is located on the south bank of the cooling pond (Figure 10), was identified as a hydraulic leak beneath the log processing track. A worst-case sample of the excavated soil was analyzed for extractable petroleum hydrocarbons (EPH) and it contained an EPH concentration of 573,000 milligrams/kilogram (mg/kg). The soil was disposed of at the Allied Waste sanitary landfill (f/k/a BFI) in Missoula, Montana. Confirmation soil samples collected from the excavation indicated that hydrocarbon impacts remained following the removal. The confirmation soil sample with the highest EPH concentration (10,000 mg/kg) was also analyzed for PCBs and it contained a PCB concentration of 30 mg/kg.

Several phases of subsurface soil and ground water investigation were conducted between 2004 and 2007 in the Fire Pond Lagoon and East Log Track areas. The investigations focused on petroleum hydrocarbons and no samples were analyzed for PCBs. The investigations identified concentrations of EPH fractions in subsurface soil that exceed DEQ risk-based screening levels (RBSLs) at both locations. Hydrocarbon impacts to ground water were observed in the Fire Pond Lagoon area but not the East Log Track area (Figure 10), both as non-aqueous phase liquid (NAPL) floating on the ground water surface and dissolved in the water. One ground water sample has been collected from a well (MW-6) located near the East Log Track area release and elevated concentrations of EPH were not detected in that sample.

Both the Fire Pond Lagoon and East Track areas are listed as active DEQ release sites and additional investigation and corrective action are planned. Stimson Lumber has proposed installing additional monitoring wells and conducting periodic ground water monitoring to assess the impacts from continued drawdown of the Blackfoot River as the Milltown Dam is removed.

3.0 SITE CHARACTERIZATION SUMMARY

The objective of the Site characterization was to evaluate the chemical and physical characteristics of the pond sediment and berm fill material at the Site while generating a database which met the requirements necessary to complete a detailed analysis of remediation alternatives. The data generated to support this task include the following.

- Site topography and pond bathymetry.
- Vertical and lateral distribution of potential contaminants in pond sediment and berm fill material.
- Physical characteristics of pond sediment and berm fill material.
- Depth to ground water and ground water flow direction.
- Concentrations of potential contaminants in ground water beneath the Site.
- Aquifer hydraulic conductivity.

The Site characterization was conducted in two phases. The first phase occurred in the Spring of 2006 at which time four borings were completed into the pond sediment. Samples collected from the borings were analyzed for a broad range of organic and inorganic compounds since the types of historical discharges to the cooling pond were unknown. The target analyte groups for the first phase of the investigation included pH, Eh, total metals, volatile petroleum hydrocarbons (VPH), EPH, volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), herbicides, and pesticides. Selected samples were also analyzed for hazardous waste characteristics using the toxic characteristic leaching procedure (TCLP). The samples were analyzed by Northern Analytical Laboratories located in Billings, Montana. The results of that investigation were presented in a Site Characterization Report (Olympus, 2006b) dated May 31, 2006. The investigation identified the presence of elevated concentrations of petroleum hydrocarbons and polychlorinated biphenyls (PCBs) in the pond sediment.

A second investigation phase of pond sediment and berm fill material quality was conducted in the Fall of 2006 to further assess the distribution of elevated concentrations of petroleum hydrocarbons and PCBs in the pond sediment and berm fill material. The samples were analyzed by the US Environmental Protection Agency (EPA) Region 8 Technical and Management Services Analytical Laboratory located in Golden, Colorado. The Fall 2006 investigation was also expanded to include the assessment of surface water in the pond and sediment in the Blackfoot River. The results of the Fall 2006 investigation are presented in this EE/CA.

The principal techniques used for data acquisition in the site investigations were topographic mapping from aerial photographs, collection of subsurface soil samples using core and sonic drill rigs, installation of monitoring wells in selected borings, measurement of static water levels in the monitoring wells, collection of ground water samples from the monitoring wells, collection of surface water samples from the pond, measurement of aquifer hydraulic conductivity through slug testing, and collection of surface sediment samples from the Blackfoot River. Site characterization work was conducted following Sampling and Analytical Plans (Olympus 2006a and 2006c), which included sample collection procedures, analytical protocols, quality assurance/quality control measures, and health and safety plans. A list of samples collected and the analyses performed on them are provided in Table 1.

Screening levels were developed in the Sampling and Analytical Plans to evaluate soil and sediment quality relative to potential health threats associated with uncontrolled disposal of the material. The screening levels are not to be considered as cleanup goals, but as concentrations at which further consideration is necessary. Screening levels are included in the analytical data tables for comparison purposes.

3.1 Cooling Pond and Berm Topographic Survey

A topographic survey of the berm was prepared by Missoula Blueprint using aerial photographs acquired on April 22, 2004. These aerial photographs were acquired prior to the removal of the Bonner Mill dam. The water level in the Blackfoot River dropped approximately 10 to 12 feet following dam removal. Olympus used a total station to survey additional points along the toe of the cooling pond berm on November 21, 2006, to extend the map topography to the river level and to survey the borehole and monitoring well locations. The river level ranged from approximately 3253.1 to 3255.7 at the lower and upper ends of the cooling pond berm, respectively. The revised topographic map is shown on Figure 11.

Water from the cooling pond historically discharges to the Blackfoot River from a pipe outlet located in the eastern area of the cooling pond. However, during the October 2006 sediment sampling, the surface elevation of the pond was approximately 3.75 feet lower than the pipe outlet (Photograph 6). The pond is not currently draining to the Blackfoot River from the outlet pipe through the berm. A seep was observed in the Blackfoot River bank near the western end of the pond as shown on Figure 12 during a Site visit on September 11, 2006, and the pond may be leaking in this area (Photograph 7). The topographic map on Figures 11 and 12 depicts the pond bathymetry, as projected from borings, rather than the pond surface.

3.2 Blackfoot River Sediment Characterization

Sediment samples were collected from the Blackfoot River to assess the potential for PCB and hydrocarbon impacts related to pond outfall. The sample locations were selected to assess background conditions (BR-S-3), conditions at the constructed pond outfall near the eastern end of the pond (BR-S-2), and conditions at the location of the seep near the western end of the pond (BR-S-1). The sample locations are shown on Figures 12 and 13.

Blackfoot River sediment samples were collected on November 7, 2006, adjacent to the shoreline in water depths of less than one foot. The samples were representative of the depth interval of 0 to 2 inches below riverbed surface and were collected using a decontaminated stainless steel scoop. The samples were placed directly into sample jars, labeled and stored in a cooler on ice for transport to the analytical laboratory. The samples were shipped, under chain-of-custody, to the US Environmental Protection Agency (EPA) Region 8 Technical and Management Services Analytical Laboratory located in Golden, Colorado. There they were analyzed for the following constituents:

- polycyclic aromatic hydrocarbons (PAHs) according to EPA Method 8270;
- PCBs according to EPA Method 8082; and,

- EPH according to the Massachusetts Method, which is modified from EPA Method 8270.

The laboratory reports and data validation forms are provided in Appendix B and the analytical results are summarized on Table 2. Target analytes were not detected in the samples above method reporting limits with the exception of PCBs, in the form of Aroclor 1254, in the sediment sample collected from near the seep (BR-S-1). The PCB concentration was 0.174 mg/kg, which is less than the PCB screening level of 0.22 mg/kg.

3.3 Surface Water Characterization

Two surface water samples were collected from the cooling pond at locations near borings B-1 (Sample B1-W-1) and B-2 (Sample B7-W-1). The samples were collected by dipping clean sample jars directly into the pond. The sample jars were labeled and placed into coolers with ice for transport to the analytical laboratory. The samples were shipped, under chain-of-custody, to the US Environmental Protection Agency (EPA) Region 8 Technical and Management Services Analytical Laboratory located in Golden, Colorado. There they were analyzed for the following constituents:

- PAHs according to EPA Method 8270;
- PCBs according to EPA Method 8082; and,
- EPH according to the Massachusetts Method, which is modified from EPA Method 8270.

The laboratory reports and data validation forms are provided in Appendix B and the analytical results are summarized on Table 3. Target analytes were not detected in the samples above method reporting limits.

3.4 Pond Sediment and Berm Soil Characterization

Pond sediment and berm soil characterization was conducted through the collection of soil and sediment samples from borings advanced in the pond and berm. Boring locations are shown on Figure 12. Borings were advanced in the pond by Salisbury and Associates, Inc. of Spokane, Washington, using a hydraulic core drill mounted on a floating aluminum drill platform (Photograph 8). A piston-driven Shelby tube sampler or a split spoon sampler were used to collect continuous soil samples at two-foot or 18-inch intervals, respectively, from the sediment/water interface to the depth of sampler refusal. Borings were advanced on the pond berm (Photograph 9) using a sonic drill rig (Photograph 10) owned and operated by Environmental West Exploration of Spokane, Washington. Samples were collected in 10-foot cores and the borings were advanced until it appeared that native alluvium was intersected.

Four borings (B1 through B4) completed in March 2006 were described in a previous Site characterization report (Olympus, 2006b). An additional five soil borings (B5 through B9) and one hand auger boring (B10) were advanced in the cooling pond in October 2006. These soil borings were located to characterize sediment adjacent to soil boring B2 (B5, B6, B7, and B8), which contained the highest concentration of PCBs, and cooling pond influent areas (B9 and B10). Thirteen borings (B11 through B23) were advanced located along the length of the berm in November 2006.

3.4.1 Physical Characteristics and Volume Calculations

Subsurface soil samples collected from the borings were logged in the field for physical characteristics and soil boring logs, which include boring and sampling information, sample descriptions, and field observations, are provided in Appendix C. The soil boring locations and logs were used to develop cross sections of the cooling pond and berm area and to estimate the type and volume of fill materials that comprise the cooling pond and berm.

In general, there were six types of material that were encountered at the site: 1) surface wood debris, 2) overburden fill, 3) other berm fill, 4) pond sediment, 5) buried log/wood debris, and 6) native alluvium. Surface models of the existing topography, the base of the surface wood material, the top and bottom of the pond sediment, the top of the overburden, the top of the log/wood debris and other berm fill layers, the native alluvium and the ground water surface were developed using data from the existing topography, the drill holes, and interpretation of the historical aerial photographs. Cross sections of the cooling pond berm area were extracted from the surface models; the cross section baseline and stations are shown on Figure 14 and the cross sections are shown on Figures 15 through 20.

The surface wood debris is generally located east of the cooling pond. The approximate extent of the surface wood debris that would require removal to facilitate removal of the cooling pond and berm is shown on Figure 21. The surface wood debris consists of log yard waste, which is a mixture of rock, soil, bark and wood fragments that builds up over time in the log yard area (Photograph 11). Figure 21 shows the existing surface after the removal of surface wood debris east of the cooling pond.

The overburden fill and other berm fill categories are differentiated by their location within the berm rather than by material type (Figures 15 through 22). The approximate extent of overburden fill is shown on Figure 21. The overburden fill includes material that overlies the pond sediment, or berm material that is at an elevation greater than the top of the pond sediment. The overburden fill is material that would need to be removed to facilitate the removal of pond sediment. The other berm fill category is material that is located on the outer perimeter of the berm adjacent to the pond sediment, or berm fill placed east of the pond area outside of the existing and former pond areas. The approximate extent of other berm fill is shown on Figure 22. Both the overburden fill and other berm fill consist primarily of sand and gravel, but also include riprap, wood cribbing and any other material that was used in the construction of berm (i.e., concrete was observed on the bank of the berm and may be present in the berm, but was not observed in the borings). Figure 22 shows the projected surface after the removal of the overburden. The exposed surface left after removal of the overburden is the top of the pond sediment and other berm fill along the northern perimeter of the pond berm and east of the pond.

The pond sediment and buried log/wood debris both consist of wood material, but are distinctly different. The pond sediment is primarily a mixture of wood chips and very fine grained organic material, with minor sand, silt, clay, and lesser interbedded gravel. The approximate extent of pond sediment is shown on Figure 22. The log/wood debris material is made up of solid wood material and is most likely comprised of sunken and buried logs, and other wood debris from historical log handling and/or debarking operations when the pond was used for log storage. This is consistent with field observations in the Blackfoot River after the Bonner Mill dam was removed (Photographs 12 and 13). Abundant sunken and buried logs were observed after the removal of the dam. The approximate extent of the logs/wood debris as interpreted from the soil borings is shown on Figure 23. However, logs and wood debris may also be encountered in other portions of the pond and berm (Photographs 7). Figure 23 shows the projected surfaced after the removal of the overburden and pond sediment. This figure also portrays the top of the logs/wood debris and the top of the other berm fill layers.

The river level ranged from approximately 3253.1 feet above mean sea level (fmsl) at the northwest corner of the pond berm to approximately 3255.7 fmsl at the upstream end of the berm when the berm was surveyed in November 2006. The elevation of the bottom of the pond sediment is as low as approximately 3244.6 fmsl (Figure 23) and the base of the pond sediment is up to 10 feet below the existing river level.

Figure 24 shows the projected native surface beneath the cooling pond, log/wood debris, and other berm fill. The native surface was encountered at an elevation as low as 3243.6 fmsl in boring B-1 in the east end of the pond. Based on these values and the river level, the native surface may be as much as 12 feet below the river level and nearly the entire native surface in the cooling pond and berm area is expected to be below the existing river level.

Thickness contours of the surface wood debris, overburden, pond sediment, buried log/wood debris and total pond fill (including overburden, pond sediment, other fill and logs/wood debris) are shown on Figures 25, 26, 27, 28 and 29, respectively. Figure 25 shows that the surface wood debris is generally 5 to 10 feet thick. Figure 26 shows that the overburden is approximately 7 to 13 feet thick in the berm area north of the cooling pond and is approximately 11 to 24 feet thick in the area east of the cooling pond. Figure 27 shows that the pond sediment is generally 5 to 15 feet thick in the existing cooling pond area (approximately Stations 2+30 to 7+10) and generally about 10 to 15 feet thick east of the cooling pond (approximately Stations 7+10 to 10+90). Figure 28 shows that log/wood debris layer is generally less than 5 feet thick, except from Stations 7+50 to 9+00, where it is up to 8 feet thick. It should be noted that the log/wood debris layer could be highly variable based on the nature of the past pond use and observations of log and wood debris in the Blackfoot River after the removal of the Bonner Mill dam (Photographs 7, 12 and 13). Figure 29 show that the total fill thickness for the pond and berm, including overburden, pond sediment, other alluvial fill and buried logs and wood debris, is generally in the range of 20 to 30 feet with maximums of approximately 33 feet in the vicinity of Stations 4+50 to 5+00 and 9+50 and 35 feet in the vicinity of Station 7+40.

The volume of surface wood debris, overburden material, pond sediment, other fill and logs/wood debris were calculated using the surface models that were developed from topographic survey, soil boring data and aerial photograph interpretations. The material volumes are summarized below.

Material Type	Volume (Cubic Yards)
Overburden	45,100
Cooling Pond Sediment	31,800
Other Berm Fill	28,300
Buried Logs/Wood Debris	4,000
Total Cooling Pond/Berm Fill	109,200
Surface Wood Debris	8,500
Total Material	117,700

The overburden fill and other berm fill layers could include riprap, alluvial fill and logs (Photograph 14), wood cribbing and any other material that was used in the construction of that portion of the berm. During a Site visit, large pieces of concrete debris were observed (Photographs 15 and 16) on the edge of the berm and it is possible that they could also be encountered in the berm fill.

An anomaly that was encountered during drilling was a void in the area of boring B17 over the depth interval from 18-38 feet below ground surface. Boring B17 is located near the east end of an exposed portion of the wood-crib retaining wall in the berm and immediately west of the cooling pond outlet piping. The cause of the void is unknown. Based on historical photographs (Section 3.2), it is believed that the cooling pond berm was constructed over wood cribs in the Blackfoot River. The void may be the result of wood decay and settlement of wood cribbing, from erosion of fill material from within a wood crib, from erosion of fill from a piping failure from the pond outlet or from another unknown cause. It is also possible that boring B17 intersected a vault or caisson that was present in the retaining wall as part of historic pond operations. Borings B22 and B23 were advanced to the east and west of boring B17, respectively. Neither boring B22 nor B23 showed evidence of a void, indicating that the void is not wide-spread within the berm. Riprap has been placed in several locations along the north side of the berm, including directly north of boring B17. This riprap was probably placed to provide additional stability and/or erosion protection for the berm.

3.4.2 Sediment and Soil Analytical Results

Pond sediment samples collected during the first phase of work in the Spring of 2006 were analyzed for a wide range of constituents and based on those results, the constituents of concern for the Fall 2006 investigation were condensed to EPH (including PAHs,) and PCBs, which were the analytical suites for the samples collected in the Fall of 2006. The samples collected in the Spring of 2006 were analyzed by Northern Analytical Laboratories, located in Billings, Montana and the data were previously presented in a Site Characterization Report (Olympus 2006b). The samples collected in the Fall of 2006 were analyzed by the EPA Region 8 Technical and Management Services Laboratory in Golden, Colorado and those data are presented in this EE/CA. The Fall 2006 laboratory reports and associated data validation forms are provided in Appendix B. The PCB analytical results initially reported by the EPA laboratory were received on a wet-weight basis, while PCBs are regulated on a dry-weight basis. The laboratory analyzed for moisture content and provided those data to Olympus, who converted the PCB results to a dry weight basis as listed in the summary table. For those samples, the results in the table differ from the results on the laboratory reports because of this conversion. This conversion was not applied to results from samples B21-S-1, B21-S-2, B22-S-1, B-22-S-2, B22-S-3, B22-S-4, B23-S-1, B23-S-2, B23-S-3, B23-S-4, B23-S-5 and B23-S-6 because the EPA modified their analytical method and reported those results on a dry-weight basis.

The analytical results from both sampling events are summarized in Tables 2, 3, 4, 5, 6, 7 and 8, along with the respective site screening levels for comparison purposes. The only constituents detected in the sediments and fill that exceeded project screening levels were PCBs, C11-C22 range aromatic hydrocarbons, C19-C36 range aliphatic hydrocarbons, and manganese. The manganese screening level was exceeded in only two samples (B4-S-1 and B4-S-2), which were collected from boring B4. Samples B4-S-1 and B4-S-2 were collected from the pond sediment and they also contained concentrations of PCBs that exceeded project screening levels.

The C11-C22 range aromatic hydrocarbons screening level (400 mg/kg) was exceeded in seven of the fourteen sediment samples collected and analyzed for EPH during the Spring 2006 sampling event, which included samples from borings B1 through B4. In addition, the C19-C36 range aliphatic hydrocarbons screening level (2500 mg/kg) was exceeded for one sample (B2-S-1) collected during the Spring 2006 sampling event and they were detected in all fourteen of the samples analyzed for EPH. The screening levels for these compounds were not exceeded in any of the samples collected during the Fall 2006 sampling event, although many of the sediment samples were collected in the same general area as sediment samples collected in the Spring 2006 event. C11-C22 range aromatic hydrocarbons were detected in four and C19-C36 range aliphatic hydrocarbons were detected in sixteen of the sixty-two samples collected during the Fall 2006 event. The reason for this discrepancy is not known, although the samples were analyzed by different laboratories. Based on these analytical results, screening level exceedances for EPH are restricted to sediment within the current pond boundaries.

The PCB screening level (0.22 mg/kg) was exceeded in all eighteen of the sediment samples collected and analyzed for PCBs during the Spring 2006 sampling event, which included samples from borings B1 through B4. PCBs were detected in samples collected from thirty-one of the sixty-two samples collected during the Fall 2006 sampling event. All detected PCBs were in the form of Aroclor-1254. The highest PCB concentrations occurred in the sediment within the pond boundaries, with the highest concentration at 65 mg/kg in sample B2-S-2. This was the only sample that exhibited a PCB concentration above 50 mg/kg, which is a trigger value in the Toxic Substances and Control Act (TSCA) for disposal options. A field duplicate (B2-S-2D) of this sample (B2-S-2) contained a PCB concentration of 47 mg/kg.

PCBs were detected in sediment within the pond boundaries and in sediment and fill material in the pond embankment, although it was restricted to samples collected in the western half of the study area as shown on Figure 30. The distribution of PCBs is depicted in the cross-sections and longitudinal profiles shown on Figures 31 through 37. The cross section and profile locations are shown on Figure 14. The data show that PCB distribution is widespread in the pond sediment at the current pond location and that pond sediment PCB concentrations decrease with distance from the current pond location. For example, PCBs were not detected in pond sediment samples located east of the current pond location (borings B-11, B-18, B-19, B-20, and B-22), but were present in pond sediment samples collected from borings located north of the current pond (B-16, B-17, and B23). The cross sections also show that PCBs are distributed in a spotty, random pattern in the fill material across the western portion of the cooling pond and berm.

3.5 Ground Water Monitoring and Aquifer Characterization

Ground water monitoring and aquifer characterization were conducted to evaluate dewatering and water treatment needs during pond removal. The work was accomplished through the following tasks.

- Installing monitoring wells in three of the borings.
- Surveying the locations of the new and relevant pre-existing Site monitoring wells.
- Measuring static water levels in the new and relevant pre-existing Site monitoring wells.
- Measuring hydraulic conductivity in the alluvial aquifer using a slug-test method.

- Collecting and analyzing ground water samples for PCBs and EPH.

Monitoring wells M1, M2, and M3 were installed in borings B14, B16, and B23, respectively. The wells were constructed of two-inch threaded PVC well casing with ten-foot screened intervals. Monitoring well construction logs are provided in Appendix C. Wells M1 and M3 were installed in the alluvial aquifer beneath the Site and well M2 was installed in a perched aquifer that is recharged by the cooling pond.

3.5.1 Aquifer Characteristics

Aquifer characterization was conducted through visual observation of soil samples collected from the borings, measurement of static water levels in Site monitoring wells, and measurement of hydraulic conductivity using slug tests in the monitoring wells completed in the water table aquifer (wells M1 and M3).

Ground water was observed in two aquifers at the Site. There is a widespread unconfined aquifer that occurs in the native alluvium and berm fill material that is in hydraulic communication with the Blackfoot River and the cooling pond. There is also an unconfined, perched aquifer that occurs where permeable fill material overlies relatively impermeable fill and pond sediment beneath the berm embankment near the pond. The perched aquifer appears to be primarily recharged by the pond and would likely cease to exist if the pond were drained. The ground water surfaces of the two aquifers are shown in the cross sections on Figures 31, 32, 33, 34, and 37. The top of the perched aquifer occurs at depths of 7 to 8 feet below ground surface and it ranges up to several feet in thickness. The top of the alluvial aquifer occurs at depths of 17 to 35 feet below ground surface and its thickness is unknown.

Ground water flow direction and gradient were assessed by measuring static water levels in the Site monitoring wells, including newly installed well M1, M2, and M3, as well as previously existing monitoring wells MW-1, MW-3, MW-4, MW-5, MW-6, and EW-1. The previously existing monitoring wells were installed by Stimson Lumber Company to assess impacts related to historical releases of hydraulic fluid. All of these wells were located relative to each other using a Nikon Total Survey Station and static water levels were measured using an electronic water level probe on November 21, 2006. Static water levels are presented in Table 9. These static water levels, along with the cooling pond water level and river level, which was surveyed along the toe of the cooling pond berm, were used to prepare a potentiometric map of ground water within the cooling pond berm. Based on the static water levels, well M-2 has a perched water table and the water level is approximately 7 feet higher than wells M-1 and M-3. Therefore, well M-2 was not considered when preparing the potentiometric map. Perched water was also encountered in the cooling pond berm in borings B15, B17, B18, B22, and B23. The potentiometric surface of the alluvial aquifer is shown on Figure 38. Figure 38 shows that a ground water mound occurs beneath from the cooling pond, with ground water flowing north toward the Blackfoot River on the north side of the pond and flowing toward the south on the south side of the pond. If the pond were not present, it appears that the Blackfoot River would be recharging the alluvial aquifer and the flow beneath the pond would generally be towards the south at a gradient of approximately 0.05 feet/feet (ft/ft).

Slug tests were conducted by Olympus personnel in Site monitoring wells on April 17 and 18, 2007. A slug test is a primary method for estimating the hydraulic characteristics of aquifer materials surrounding the screen of a low yielding monitoring well. There are two basic procedures for conducting slug tests. The first, known as a falling head test, consists of suddenly introducing a closed cylinder of known volume (also known as a slug) into the well. The second procedure, known as a rising head test, is accomplished by suddenly removing the slug from the well. The rate at which the water level in the well falls or rises after the slug is either introduced or removed is directly controlled by the hydraulic conductivity of the aquifer, which can be estimated from the amount of time it takes the water level to return to static equilibrium.

Three monitoring wells (M1, M2, and M3) were initially selected for slug testing. Well M2 did not have a water column of sufficient length and therefore was not tested. The slugs used during the tests were constructed of PVC pipe with threaded end-caps. The slugs were filled with sand and the end-caps were sealed with a silicone caulk in order to prevent water from entering the slugs.

At the beginning of each test, the static water level and the total depth of the well were recorded. An electronic pressure transducer (Aquistar PT2X, SN: 2540034) was lowered into the well. The pressure transducer cable was secured to the top of the well casing to ensure the sensor would not move during the test. The pressure transducer was programmed to record water level readings at pre-determined intervals throughout the test. Following transducer placement, the water level was allowed to stabilize and the slug was placed in the water column to initiate the falling head test. Water level readings were monitored until they returned to static levels and the test was deemed complete. Once the water level had stabilized at the static level, the rising head test was started by quickly removing the slug from the well. The water level was again monitored until it became static. Three falling head tests and three rising head tests were conducted in each well.

The data recorded during the slug tests at the Site were analyzed using the Bouwer and Rice method (Bouwer and Rice, 1976). The Bouwer and Rice method was utilized because it was designed to estimate the hydraulic conductivity of aquifer material in a single well while taking into account the geometry of partially penetrating or fully penetrating wells in an unconfined aquifer. The method calculation sheets are provided in Appendix D. The response slopes obtained from the slug tests were not straight lines and professional judgment was used to select the steepest reasonable slope, which would result in the highest hydraulic conductivity and yield from dewatering wells. This provides a conservative estimate of the level of effort required to dewater the Site during sediment removal. While the calculations were made for both a partially penetrating well in an aquifer of infinite thickness and a fully penetrating well, the values selected for further analysis were those for a partially penetrating well in an aquifer of infinite thickness; which more likely matches Site conditions.

Hydraulic conductivity values calculated for well M1 ranged from 439 to 505 gallons per day per square foot (gpd/ft^2) with an average value of 472 gpd/ft^2 for the falling head test. The rising head test results for well M1 ranged from 110 gpd/ft^2 to 165 gpd/ft^2 with an average value of 138 gpd/ft^2.

Hydraulic conductivity values calculated for well M3 ranged from 38 gpd/ft^2 to 71 gpd/ft^2 for the falling head test with an average value of 51 gpd/ft^2. The rising head test results for well M3 ranged from 6 gpd/ft^2 to 28 gpd/ft^2 with an average value of 21 gpd/ft^2.

The hydraulic conductivity values calculated from the falling head tests are slightly more than two times that calculated from the rising head tests. This is attributed to the fact that the falling head test measures the hydraulic conductivity of the aquifer and the vadose zone above the aquifer because the well screen intersects the water table surface while the rising head test only measures the hydraulic conductivity of the saturated sediments. These results indicate that the hydraulic conductivity of the vadose zone is higher than the saturated zone. The aquifer is recharged by the Blackfoot River and it is possible for higher river levels to cause the water table to rise into the more permeable sediments that were unsaturated at the time of the test.

3.5.2 Ground Water Chemistry

Ground water samples were collected from monitoring wells M1 and M3. Well M2 was scheduled for sampling but it did not produce sufficient water for sample collection. Ground water samples were collected in accordance with the SAP (Olympus, 2006a). The samples were collected with a disposable polyethylene bailer after three well volumes of water were purged from the wells. Water quality parameters of dissolved oxygen, temperature, pH, and oxidation-reduction potential were measured during purging and the samples were not collected until those parameters had stabilized. The ground water samples were shipped under chain-of-custody procedures to the EPA laboratory in Golden, Colorado for PCBs and EPH analysis. The laboratory reports are provided in Appendix B and the results are summarized in Table 3.

The only target analyte detected in the ground water samples was PCB in the form of Aroclor 1254 in the natural and field duplicate samples collected from well M3. The PCB concentration was 0.81 micrograms/liter (µg/l) in the natural sample and 1.7 µg/l in the field duplicate. The concentrations exceed the project screening level of 0.034 µg/l.

4.0 SUMMARY OF THE APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

The Stimson Lumber Company Cooling Pond project is being completed in conjunction with the Milltown Reservoir Sediments Operable Unit of the Milltown Reservoir/Clark Fork River Superfund Site. A description of applicable or relevant and appropriate requirements (ARARs) was prepared by the U.S. Environmental Protection Agency Region 8 and Montana DEQ in December 2004 for the Milltown Reservoir Sediments Operable Unit Record of Decision. The Milltown ARARs are included in Appendix E. Wastes regulated under the TSCA, such as PCBs, were not anticipated as part of the Milltown Reservoir sediment project and were not included in the ARARs. Since PCBs are the primary CoC at the cooling pond and berm, an addendum to the Milltown ARARs that addresses TSCA requirements has been prepared and is also included in Appendix E.

5.0 REMEDIAL ACTION OBJECTIVES AND PRELIMINARY REMEDIATION GOALS

5.1 Contaminants of Concern

Identifying the contaminants of concern (CoCs) is a prerequisite to developing remedial action objectives. An evaluation of the site characterization analytical data was used to develop the contaminants of concern. The following constituents were detected in the cooling pond sediments and fill at concentrations that exceeded the project screening levels

- PCBs,
- C11-C22 range aromatic hydrocarbons,
- C19-C36 range aliphatic hydrocarbons, and
- manganese.

These constituents are identified as the CoCs for the Site.

5.2 Remedial Action Objectives

The primary objective of remediation in the project area is to protect human health and the environment in accordance with the guidelines set forth by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the National Contingency Plan (NCP) (EPA, 1990), as well as applicable State law, including the Comprehensive Environmental Cleanup and Responsibility Act (CECRA). Specifically, the remedial action objectives are: 1) to eliminate potential human health risk and environmental exposure to the CoCs in solid media (impacted cooling pond berm fill, impacted cooling pond sediment, and impacted logs and wood debris) at the Site, 2) to eliminate the adverse impacts of the CoCs on the local water resources; and 3) to eliminate the threats posed to human health and the environment by the potential failure of the cooling pond berm.

5.3 ARAR-Based Remediation Goals

5.3.1 Ground Water

ARAR-based remediation goals are most often the maximum contaminant levels (MCLs), non-zero maximum contaminant level goals (MCLGs), or state drinking water standards, whichever are more stringent. Potential ARAR-based remediation goals for the CoCs in the ground water medium are presented in Table 10.

5.3.2 Surface Water

Aquatic Life Standards and Human Health Standards are common ARARs for the surface water medium. The more stringent of the two standards is identified as the ARAR-based remediation goal. The potential contaminants of concern at the site are: PCBs, C11-C22 range aromatics hydrocarbons, C19-36 range aliphatics hydrocarbons, and manganese. The ARAR-based remediation goals for surface water are presented in Table 11.

5.3.3 Soil

Chemical-specific ARARs are not available for petroleum hydrocarbons at this time for the soil medium.

The EPA has established cleanup requirements for PCB remediation waste in 40 CFR Part 761.61 as summarized in Table 12. The cleanup level for bulk PCB remediation waste in high occupancy areas is less than 1 mg/kg. The EPA Regional Administrator may require cleanup to more stringent levels based on the proximity to sensitive areas, including wetlands and sport fisheries.

5.4 Risk-Based Cleanup Goals

Preliminary risk-based cleanup goals are published for certain constituents by both the EPA and DEQ. EPA Region 9 has published preliminary remediation goals (PRGs) for soil and water (EPA, 2004). The Montana DEQ has published risk-based screening levels for petroleum hydrocarbon constituents (DEQ, 2003). The risk-based cleanup goals for soil and water based on industrial use published by EPA and DEQ are presented in Table 13.

Although no residences are located within the Site boundary, there are homes located along Highway 200, approximately 1,000 feet southeast of the Site. Future land use at the Site could easily change, and residential use is a reasonably likely future land use for the Site because of the proximity to the river. Risk-based cleanup goals for soil and water based on residential use published by EPA and DEQ are presented in Table 14.

6.0 DEVELOPMENT AND SCREENING OF REMEDIATION ALTERNATIVES

The screening of remediation alternatives is a multi-step process in which treatment technologies and remediation alternatives are evaluated and either retained or eliminated based on a set of evaluation criteria. Each subsequent step in the screening process provides a more rigorous evaluation of options that are retained. For the Stimson Lumber Company cooling pond, the screening was performed in the following five steps:

- A large number of treatment technologies were initially evaluated to eliminate technologies that are not fully developed or have not been proven to be potentially effective for treatment of PCBs and hydrocarbons (see Section 6.1).

- Treatment technologies that were retained after evaluation in Section 6.1 are grouped into various categories of general response actions, technologies, and process options and are then evaluated based on the criteria of implementability, effectiveness, and cost (see Section 6.2).

- The general response actions, technologies, and process options that are retained after evaluation in Section 6.2 are grouped into remediation alternatives and subject to a preliminary evaluation (see Section 6.3).

- Remediation alternatives that are retained after the preliminary evaluation in Section 6.3 are subject to a detailed analysis (see Section 7.0).

- Remediation alternatives that are retained after the detailed evaluation are compared (see Section 8.0), and a preferred remediation alternative is selected (see Section 9.0).

To facilitate the evaluation of potentially applicable remediation technologies, the solid media at the site can be divided into the following general categories based on physical and/or chemical characteristics.

- surface wood debris;
- PCB- and/or hydrocarbon-impacted overburden fill;
- non-impacted overburden fill;
- PCB- and/or hydrocarbon-impacted other berm fill;
- non-impacted other berm fill
- PCB- and/or hydrocarbon-impacted pond sediment;
- PCB- and/or hydrocarbon-impacted buried logs and wood debris; and
- native alluvium.

The physical characteristics and volumes of each media are described in Section 3.4.1. The chemical characteristics of the media, based on the analytical results, are described in Section 3.4.2. As shown in Section 3.4.2, PCBs are the most wide-spread CoC at the Site and are therefore used as an indicator parameter to distinguish impacted versus non-impacted material associated with the site. Figures 30 through 37 show the extent of PCB-impacted materials. As shown on Figure 37, PCBs were detected in the overburden material and pond sediment west of Station 9+00, but not east of Station 9+00. Overburden from Station 0 to 9+00 is considered impacted, while overburden east of Station 9+00 is considered non-impacted. Although some overburden samples collected west of Station 9+00 did not contain elevated concentrations of

PCBs, all of the overburden will be treated as impacted since the distribution of PCBs is intermittent and cannot be verified by visual observation. Sorting non-impacted overburden from impacted overburden in that area is not considered feasible. PCBs were detected in the pond sediment from approximately Station 2+30 to Station 6+70 (Figure 37), but not detected east of Station 6+70; however, all of the pond sediment is being considered as potentially impacted. PCBs were detected intermittently in the western portion of the other berm fill, but were not detected east of Station 9+00. The other berm fill is considered impacted from Station 0+00 to Station 9+00 for the same reasons as described for the overburden material. Based on the historical aerial photographs (Figures 5 through 8) and field observations, there are an estimated 2,200 cubic yards of wood crib material in the other berm fill material between Stations 9+00 and 14+00. This wood crib material may or may not be impacted, but is being considered a waste material. Similarly, the buried logs/wood debris material may or may not be impacted, but is being considered a waste material. The surface wood material (log yard waste) has not been tested, but is not being considered a waste material. It has been assumed that the surface wood material that will require removal will remain on site.

The breakdown of impacted versus non-impacted materials is as follows:

Material Type	Volume (Cubic Yards)		
	Impacted Material	Non-Impacted Material	Total
Overburden	32,300	12,800	45,100
Cooling Pond Sediment	31,800	0	31,800
Other Berm Fill	16,900	11,400	28,300
Buried Logs/Wood Debris	4,000	0	4,000
Total Cooling Pond/Berm Fill	85,000	24,200	109,200
Surface Wood Debris	0	8,500	8,500
Total Material	85,000	32,700	117,700

Treatment of the solid media is dependent on the concentration of CoCs in the media, as well as the physical characteristics of the media. The potential applicability of a technology is dependent on the interrelationship of remediation technologies and the type and volume of material requiring treatment.

6.1 Identification and Screening of Treatment Technologies

Various remediation technologies were evaluated and screened using the information provided by the Federal Remediation Technologies Roundtable (FRTR) Remedial Technologies Screening Matrix (FRTR, 2007). The FRTR is a collaboration among federal agencies involved in hazardous waste site cleanup, including the U.S. Department of Defense, Environmental Protection Agency, Department of Energy, Department of the Interior, and National Aeronautics and Space Administration. The screening matrix lists biodegradation, dehalogenation, incineration, and excavation with off-site disposal as common treatment technologies for halogenated SVOCs (which includes PCBs) in soil, sediment, and sludge.

Various treatment technologies are rated by the FRTR as above average, average, or below average based on the following factors:

- development status,
- treatment train,
- overall cost and performance (O&M; capital; system reliability and maintainability; relative cost; and cleanup time),
- availability of the technology, and
- contaminants treated.

Table 15 presents a screening matrix for treatment technologies considered by FRTR. A remediation technology was retained for further screening if it was rated average or above average for development status, treatment train, and demonstration with the contaminant to be treated. Availability of the technology and overall cost and performance are considered in subsequent screening. Of the 28 technologies listed by FRTR for potential treatment of soil, sediment, and sludge, 11 did not meet the minimum requirements and were screened out as shown in Table 15.

6.2 Identification and Screening of General Response Actions and Remediation Technologies

General response actions are categories of actions that may be implemented to achieve the project-specific remedial action objectives. General response actions may include (but are not limited to) such categories as treatment, containment, disposal, or combinations of these categories. General response actions identified for potential remediation of the Stimson Lumber Company cooling pond and berm include the following:

- No Action;
- Monitored Natural Attenuation;
- Institutional Controls;
- Containment;
- In Situ Treatment;
- Removal;
- Ex Situ Treatment; and
- Disposal.

To facilitate the evaluation, the general response actions are further divided into remediation technology types and process options. The purpose of identifying and screening remediation technology types and processes is to eliminate those technologies and process options that are not feasible. The screening criteria included technical implementability, effectiveness and cost.

Implementability

Implementability encompasses both the technical and administrative feasibility of implementing a technology process. Technical implementability is used as an initial screen of technology types and process options to eliminate those that are clearly ineffective or unworkable at a site. Therefore, this subsequent, more detailed evaluation of process options places greater emphasis on the institutional aspects of implementability, such as the ability to obtain necessary permits for offsite actions, the availability of treatment, storage, and disposal services (including capacity), and the availability of necessary equipment and skilled workers to implement the technology.

Effectiveness

Specific technology processes that have been identified are evaluated further based on their effectiveness relative to other processes within the same technology type. This evaluation should focus on: (1) the potential effectiveness of process options in handling the estimated areas or volumes of media and meeting the remediation goals identified in the remedial action objectives; (2) the potential impacts to human health and the environment during the construction and implementation phase; and (3) how proven and reliable the process is with respect to the contaminants and conditions at the site.

Cost

Cost plays a limited role in the screening of process options. Relative capital and O&M costs are used rather than detailed estimates. At this stage in the process, the cost analysis is made on the basis of engineering judgment, and each process is evaluated as to whether costs are high, low, or medium relative to other process options in the same technology type. The greatest cost consequences in site remediation are usually associated with the degree to which different general technology types (i.e., containment, treatment, excavation, etc.) are used. Using different process options within a technology type usually has a less significant effect on cost than does the use of different technology types.

Only treatment technologies that were retained in Table 15 were considered in the screening of general response actions and remediation technologies. The technologies presented are grouped by general response actions. Table 16 presents the general response actions, remediation technologies, and process options that are evaluated, and summarizes the results of the screening process. Technologies and process options are first screened on the basis of technical implementability. Technologies and process options that are deemed technically implementable are further screened on the basis of effectiveness and relative cost. Process options retained in Table 16 are combined into remediation alternatives and expanded discussions and a preliminary evaluation are provided in the following section.

6.3 Identification and Preliminary Evaluation of Remediation Alternatives

The purpose of the initial screening of alternatives is to identify those remediation alternatives appropriate for a subsequent, detailed analysis. The initial screening also helps identify technology type, process options and specific data needs for detailed site characterization.

This section identifies potential remediation alternatives from the general response actions, remediation technologies, and associated process options that passed the initial screening effort presented in Section 6.2. Retained process options included no action, institutional controls, dry excavation, dehalogenation, on site disposal in a RCRA repository, off site disposal at a solid waste landfill, and off-site disposal at a TSCA facility. These retained general response, remediation technologies, and process options have been combined to form the following remediation alternatives:

Alternative 1: No Action;

Alternative 2: Institutional Controls;

Alternative 3: Dry Excavation with Ex Situ Dehalogenation;

Alternative 4: Dry Excavation with Ex Situ High Temperature Thermal Desorption;

Alternative 5: Dry Excavation with On Site Disposal in a Modified RCRA Repository;

Alternative 6: Dry Excavation with Off Site Disposal Primarily at a Solid Waste Landfill; and

Alternative 7: Dry Excavation with Off Site Disposal at a TSCA Landfill.

These alternatives are preliminarily screened in this section on the basis of effectiveness, implementability, and relative costs. The objective of the preliminary screening is to better define the number of remediation alternatives that will require detailed evaluation.

6.3.1 Cooling Pond Dewatering and Blackfoot River Diversion

Five of the seven remediation alternatives involve excavation of the pond sediment. The pond sediment extends downward into the alluvial aquifer, which is recharged by the Blackfoot River, and it also extends to depths of up to twelve feet below river level. Thus, sediment removal will require dewatering of the deeper portion of the sediment and isolating the Blackfoot River to prevent it from flooding the excavation. A preliminary assessment, described herein, of river diversion and excavation dewatering was conducted to assess feasibility and costs for these tasks.

The dewatering plan is primarily for removal of water associated with inflow from the Blackfoot River. It is assumed that the removal of the cooling pond would be coordinated with Stimson Lumber Company so that discharges to the cooling pond would be ceased so that the pond and pond sediment would dewater passively prior to removal of the pond. The pond sediment may still be too wet for transportation and disposal and may need to be mixed with drier impacted overburden material to meet moisture specifications for disposal.

6.3.1.1 Blackfoot River Diversion

Stream diversion or isolation is typically accomplished through the construction of coffer dams which, in a high-velocity environment such as the Blackfoot River, are generally constructed by driving interlocking sheet piling into the stream bank. Previous work on the Milltown Reservoir sediment removal project has indicated that sheet piling is difficult to drive because of the presence of large cobbles and boulders. Similar conditions are expected at the Stimson Cooling Pond Site. An alternative to sheet piling is the use of earthen or water-filled coffer dams, which are proposed for this Site. Water-filled coffer dams were used in the evaluation because they require a smaller footprint than earthen coffer dams and space is a limiting factor. Water-filled coffer dams typically combine two or more polyethylene or woven geo-textile tubes together and a locally available water supply to fill the coffer dam. Two inner tubes, contained by an outer "master" tube, are pumped full of water simultaneously. Counter friction between the master and inner tubes results in a stable, non-rolling "wall" of contained water, which conforms to the stream bed as the coffer dam is deployed. The filled coffer dam forms an impervious, solid wall of water that will separate the cooling pond area from the Blackfoot River.

Water filled coffer dams come in a variety of sizes and are generally twice as wide as their height. Because the stream bed has already been restricted by the Cooling Pond, the coffer dam height should be kept as small as possible. For this assessment, we have developed costs for a coffer dam with a height of 12 feet, a width of 27 feet, and a controlled water depth of 108 inches. While a more detailed assessment would be needed to select the most efficient size for this project, this sized coffer dam could be placed at the Site and it is likely large enough to provide the control needed during excavation. Some stream bed grading would be required to provide a bed that is smooth enough for effective stream control.

6.3.1.2 Dewatering Assessment

After the water-filled coffer dam is installed along the northern perimeter of the cooling pond, pumps will be used to dewater the excavation area. Water removed from the excavation area will likely require treatment prior to discharge to the Blackfoot River. Treatment will likely include settling or filtration to remove sediment and treatment with activated carbon to remove residual PCBs and hydrocarbons. In order to estimate the number of dewatering wells and volume of water that would require treatment, a ground water flow model was constructed using Modflow 2000.

The hydraulic conductivity parameters used in this model were based on field data collected at the site. Hydraulic conductivity values were calculated from slug tests conducted in monitoring wells located in the berm separating the cooling pond and the Blackfoot River as described in Section 5.3.1. The hydraulic conductivity values calculated for M1 ranged from 200 gallons per day per square foot (gpd/ft^2) to 470 gpd/ft^2 and the values calculated for well M3 ranged from 21 gpd/ft^2 to 51 gpd/ft^2. Based on the model calculations, a dewatering system with wells constructed to depths of 25 feet into the aquifer at 20 foot intervals and pumping at approximately 250 gallons per minute (gpm) in the high hydraulic conductivity zones and 90 gpm in the low hydraulic conductivity zones would provide sufficient drawdown. For every 100 feet of excavation parallel to the river in high hydraulic conductivity zones, approximately 990 gpm would have to be pumped in order to maintain sufficient drawdown in excavation areas. For every 100 feet parallel to the river in low hydraulic conductivity zones, approximately 360 gpm would have to be pumped out to maintain sufficient drawdown.

6.3.2 Alternative 1: No Action

The no action alternative means that no remediation is completed at the site to control contaminant migration or to reduce toxicity or volume. This option would require no further remedial investigation or monitoring action at the site.

<u>Effectiveness</u> - Toxicity, mobility, and volume of contaminants would not be reduced under the no action alternative. Also, protection of human health and the environment would not be achieved under this alternative. The site characterization data indicate that the cooling pond sediment and a significant portion of the pond embankment are impacted by PCBs and hydrocarbons. The cooling pond has been observed to be leaking from a seep on the pond berm. Sediment in the Blackfoot River near the seep contained detectable concentrations of PCBs, although the concentration is below the project screening levels. PCBs were also detected in ground water in one of the on site monitoring wells. These data indicate that the cooling pond may be causing environmental impacts to the ground water and Blackfoot River sediments at the Site. The no action alternative will not address potential surface water or ground water impacts nor would it provide any controls on contaminant migration via direct contact. This alternative would do nothing to address the stability of the berm, the risk of catastrophic failure, or the storage or disposal of toxic materials within the 100 year floodplain.

Implementability - Technical and administrative feasibility evaluation criteria do not apply to this alternative.

Cost Screening - No capital or operating costs would be incurred under this alternative. Monitoring costs have been estimated at $1,000 per year for annual inspections. The total present worth cost for no action, including 30 years of annual inspections at a cost of $1,000 per year, is estimated at $12,409.

Screening Summary - The no action response is generally used as a baseline against which other remediation options can be compared. This alternative has been retained for further evaluation as suggested by the NCP.

6.3.3 Alternative 2: Institutional Controls

The institutional control alternative includes land use restrictions to prevent land development on or near the impacted areas and includes erecting fences to restrict access.

Effectiveness - Access to the pond is currently somewhat limited because of fencing, gates, and the security guard to control the entrance to the Stimson facility; however, the cooling pond is located along the Blackfoot River and access along the river is not controlled. Fencing around the pond could control direct access, but could be subject to vandalism, which would render the control ineffective. This alternative is not protective of human health and the environment if it is implemented as a stand alone option. No controls would be implemented for direct contact, infiltration and leaching, erosion, or the stability of the berm. Toxicity, mobility, and volume of the contaminated media would not be reduced under this alternative.

Implementability - Institutional controls can be easily implemented. The alternative is applicable for controlling direct contact and restricting future inappropriate land development. Materials and labor are readily available. Reliability of this alternative is considered good for controlling direct contact as long as enforcement of institutional controls is maintained and deed restrictions are in place. Administrative feasibility is considered good due to the ease of implementation. This alternative, however, is not protective of the environmental resources nor is it fully protective of human health if implemented as a stand alone alternative.

Cost Screening - Table 17 presents the cost details associated with implementing this alternative. The total present worth cost for institutional controls is estimated at $187,473. Costs for institutional controls would be relatively low as compared to other remediation alternatives except no action.

Screening Summary - Institutional controls will not be considered further as a stand-alone remediation alternative, but may be used in conjunction with other selected remediation alternatives.

6.3.4 Alternative 3: Dry Excavation with Ex Situ Dehalogenation

Under Alternative 3, the cooling pond sediment and impacted berm fill would be removed by dry excavation methods and then treated by Ex Situ Dehalogenation. The upper portion of the berm (above the river level) and pond sediment can be removed without dewatering. However, removal of the lower portion of the berm and pond sediment will require dewatering. Previous work on the Milltown Reservoir site has indicated that placement of sheet piling may be difficult because of the presence of boulders in the alluvium.

With Ex Situ Dehalogenation, contaminated soil is screened, processed with a crusher and pug mill, and mixed with reagents. The mixture is heated in a reactor. The dehalogenation process is achieved by either the replacement of the halogen molecules or the decomposition and partial volatilization of the contaminants. There are two primary methods for dehalogenation: 1) base-catalyzed decomposition (BCD), and 2) Glycolate/Alkaline Polyethylene Glycol (APEG).

The BCD process was developed by EPA's Risk Reduction Engineering Laboratory (RREL), in cooperation with the Naval Facilities Engineering Services Center (NFESC) to remediate soils and sediments contaminated with chlorinated organic compounds, especially PCBs, dioxins, and furans. Contaminated soil is screened, processed with a crusher and pug mill, and mixed with sodium bicarbonate. The mixture is heated to above 330 °C (630°F) in a reactor to partially decompose and volatilize the contaminants. The volatilized contaminants are captured, condensed, and treated separately.

Glycolate is a full-scale technology in which an alkaline polyethylene glycol reagent is used. Potassium polyethylene glycol (KPEG) is the most common APEG reagent. Contaminated soils and the reagent are mixed and heated in a treatment vessel. In the APEG process, the reaction causes the polyethylene glycol to replace halogen molecules and render the compound nonhazardous or less toxic. The reagent (APEG) dehalogenates the pollutant to form a glycol ether and/or a hydroxylated compound and an alkali metal salt, which are water-soluble byproducts. Dehalogenation (APEG/KPEG) is generally considered a stand alone technology; however, it can be used in combination with other technologies. Treatment of the wastewater generated by the process may include chemical oxidation, biodegradation, carbon adsorption, or precipitation.

<u>Effectiveness</u> - This alternative would reduce contaminant toxicity at the site by reducing contaminant levels. The contaminant volume may be reduced somewhat as oversized material is screened out. The contaminant mobility would be reduced by removal of the contaminated sediment and soil from the exposure to the environment and by treatment and post-treatment management of the materials. According to FRTR (2007), PCB concentrations as high as 45,000 mg/kg have been treated to less than 2 mg/kg; however, byproducts of dehalogenation, including contaminated air, water, and sludge, may require further treatment and handling. The effectiveness of the dehalogenation process may be reduced by the high moisture content of the pond sediment and portions of the berm material. The high organic content and clay fraction of the pond sediment may also reduce the effectiveness of the process. Treatability tests should be conducted to identify parameters such as water, alkaline metals, and humus content in the soils; the presence of multiple phases; and total organic halides that could affect processing time and cost. Handling and disposal of the soil after treatment by dehalogenation will depend on the contaminant concentrations after treatment; however, it is likely that the soil and sediment will still require off-site disposal.

<u>Implementability</u> - The target contaminant groups for dehalogenation treatment are halogenated SVOCs and pesticides. APEG dehalogenation is one of the few processes available other than incineration that has been successfully field tested in treating PCBs. The technology is amenable to small-scale applications. Dehalogenation is normally a short- to medium-term process. The contaminant is partially decomposed rather than being transferred to another medium. The use of dehalogenation is both technically and administratively feasible. The equipment required is considered standard.

Cost Screening - The total present-worth cost for this alternative has been estimated at $80,378,253. Table 18 presents the cost details associated with implementing this alternative. The total cost includes the present-worth value of 30 years of annual maintenance and monitoring costs in addition to capital costs. The cost for full-scale dehologenation is typically in the range of $200 to $500 per ton, not including excavation, refilling, residue disposal, or analytical costs (FRTR, 2007). Factors such as high clay or moisture content may raise the treatment cost slightly.

Screening Summary

This alternative has not been retained for detailed analysis because of the high cost. The PCB and hydrocarbon concentrations are low enough that treatment would likely not be required prior to disposal. A similar degree of relative effectiveness can be obtained by other alternatives being evaluated at significantly reduced costs.

6.3.5 Alternative 4: - Dry Excavation with Ex Situ High Temperature Thermal Desorption

The remediation strategy for Alternative 4 involves dry excavation with ex situ High Temperature Thermal Desorption (HTTD). Thermal desorption is a physical separation process and is not designed to destroy organics. Wastes are heated to volatilize water and organic contaminants. A carrier gas or vacuum system transports volatilized water and organics to the gas treatment system. The bed temperatures and residence times designed into these systems will volatilize selected contaminants but will typically not oxidize them.

Effectiveness - HTTD is a full-scale technology in which wastes are heated to 320 to 560 °C (600 to 1,000 °F). HTTD is frequently used in combination with incineration, solidification/stabilization, or dechlorination, depending upon site-specific conditions. The technology has proven it can produce a final contaminant concentration level below 5 mg/kg for the target contaminants identified. This alternative would reduce contaminant toxicity at the site by reducing contaminant levels. The contaminant mobility would be reduced by removal of the contaminated sediment and soil from exposure to the environment and by treatment and post-treatment management of the contaminated materials.

There are specific particle size and materials handling requirements that can impact applicability or cost at specific sites. Dewatering may be necessary to achieve acceptable soil moisture content levels. Highly abrasive feed potentially can damage the processor unit. Clay and silty soils and high humic content soils increase reaction time as a result of binding of contaminants. In addition to identifying soil contaminants and their concentrations, information necessary for engineering thermal systems to specific applications include soil moisture content and classification, determination of boiling points for various compounds to be removed, and treatability tests to determine the efficiency of thermal desorption for removing various contaminants at various temperatures and residence times. A sieve analysis is needed to determine the dust loading in the system to properly design and size the air pollution control equipment.

Implementability - The target contaminants for HTTD are SVOCs, PAHs, PCBs, and pesticides; however, VOCs and fuels also may be treated, but treatment may be less cost-effective. The process is applicable for the separation of organics from refinery wastes, coal tar wastes, wood-treating wastes, creosote-contaminated soils, hydrocarbon-contaminated soils, mixed (radioactive and hazardous) wastes, synthetic rubber processing waste, pesticides and paint wastes. The use of High Temperature Thermal Desorption is both technically and administratively feasible. The equipment required is considered standard.

Cost Screening - The total present-worth cost for this alternative has been estimated at $56,811,897. Table 19 presents the cost details associated with implementing this alternative. The total cost includes the present-worth value of 30 years of annual maintenance and monitoring costs in addition to capital costs. The cost for full-scale dehologenation is estimated to be in a range of $232 per cubic yard based on treatment of SVOCs (FRTR, 2007). The quantity of material treated (economy of scale) and high moisture content (increased fuel) are key cost drivers.

Screening Summary

This alternative has not been retained for detailed analysis because of the high cost. The PCB and hydrocarbon concentrations are low enough that treatment would likely not be required prior to disposal. A similar degree of relative effectiveness can be obtained by other alternatives being evaluated at significantly reduced costs.

6.3.6 Alternative 5: Dry Excavation with On Site Disposal

The remediation strategy for Alternative 5 involves removing all identified waste sources at the cooling pond area and disposing of these wastes in a constructed repository which complies with all RCRA Subtitle C regulations for hazardous waste landfill closures (Figure 39). A RCRA Subtitle C landfill design was deemed appropriate for the repository due to its location near the Blackfoot River and a residential area where shallow ground water supply wells could be utilized. The repository would consist of a composite, double-lined leachate collection and removal system underlying the waste in conjunction with a composite, multi-layered, lined cap overlying the waste. It is assumed that the repository base can be excavated to a depth of at least two feet without interference from bedrock. The initial repository excavation will provide cover soil for capping the repository and reduce the overall height of the repository. If bedrock is encountered in the repository excavation, then additional cover soil will need to be recovered from elsewhere on site or from off site.

After the repository area has been excavated and the surface prepared, a bottom liner and leachate collection system would be installed. Once the waste sources are placed in the repository, a multi-layered cap would be constructed overlying the waste, and the repository cap would be revegetated. A runon/runoff control ditch would be constructed in the area of the repository to divert surface water away from the repository cap.

Effectiveness - This alternative would effectively reduce contaminant mobility at the site by removing the solid media contaminant sources and disposing of the waste in a secure disposal facility. Consequently, potential surface water and ground water problems would be mitigated. Contaminant toxicity and volume would not be reduced; however, the waste would be rendered immobile in a structure and physical location protected from erosion problems. Long-term monitoring and control programs would be established to ensure continued effectiveness.

Implementability - This alternative is both technically and administratively feasible. The construction steps required are considered conventional construction practices. Key project components, such as the availability of equipment, materials, and construction expertise, are all present and would help ensure the timely implementation and successful execution of the proposed plan. A problem with implementation of this alternative is that it would require the dedication of approximately 6.2 acres of on site land for the repository.

Cost Screening - The total present-worth cost for this alternative has been estimated at $6,043,963. Table 20 presents the cost details associated with implementing this alternative. The total cost includes the present-worth value of 30 years of annual maintenance and monitoring costs in addition to capital costs. Monitoring costs include 30 years of semi-annual ground water monitoring from eight monitoring wells for the parameters of PCBs, pH, specific conductance, and chlorinated organics as required under 40 CFR Part 761.75 (b)(6)((iii). The cost estimate assumes that a geotextile cushion and geosynthetic clay liner (GCL) are used rather than compacted clay soil in a typical RCRA repository design.

This present-worth cost does not include costs for acquisition of the repository property or opportunity costs associated with land use restrictions related to the repository. A complete cost screening for an on-site repository alternative would include opportunity costs associated with the land where repository is constructed. An opportunity cost is the cost associated with an opportunity forgone. In this case, the opportunity cost would be the value that could have been derived from a future beneficial use of the property. Potential future uses of the property are unknown at this time. Other sawmills in the northwest (e.g., sawmills along the Spokane River in Coeur d'Alene, Idaho) have been developed into high-end housing or commercial/retail properties. In some cases, sawmill properties have sold for multi-millions of dollars. A repository located on the Stimson property would substantially limit future uses of that portion of the property. The conceptual repository design is 300 feet wide by 900 feet long (6.2 acres). Considering an additional 100-foot wide open-space buffer around the perimeter of the repository, the land designated for the repository is approximately 12.6 acres. These 12.6 acres would be considered ineligible for any future beneficial uses. The future value of this property would be determined by the real estate market at some point in the future if or when development were to occur, and cannot accurately be predicted at this point in time. However, potential opportunity costs for the repository property should be considered when comparing alternatives.

Screening Summary

This alternative has been retained for detailed analysis because it would provide a high degree of effectiveness at a relatively low cost.

6.3.7 Alternative 6: Dry Excavation with Off Site Disposal Primarily at a Solid Waste Landfill

The strategy for Alternative 6 involves removing the contaminated solid media at the Site and disposing of approximately 84,790 cubic yards of wastes in a Class II Municipal Solid Waste (MSW) Landfill and approximately 210 cubic yards of wastes containing a PCB concentration of greater than 50 mg/kg in a TSCA landfill. The sources to be disposed of include the pond sediment, impacted overburden and berm fill, and the impacted logs/wood debris. The nearest disposal facility is the Allied Waste Landfill in Missoula, Montana, which is permitted for Class II solid wastes.

Effectiveness - This alternative would effectively reduce contaminant mobility at the site by completely removing the solid media contaminant sources from the site. Contaminant toxicity and volume would not be reduced. Removal of wastes to a Class II MSW landfill facility provides long-term monitoring and control programs to ensure continued effectiveness. However, short-term risks of exposure to the contaminated material may occur during transport to the disposal facility.

Implementability - This alternative is technically feasible. The construction steps required (excavation and loadout) are considered standard construction practices. Key project components, such as the availability of personnel, equipment and materials, are present and would help allow the timely implementation and successful execution of the proposed plan. This alternative is also administratively feasible because the PCB concentrations are, with the exception of one sample, below the threshold requiring disposal at a TSCA facility. The one sample (65 mg/kg) that exceeded the TSCA threshold of 50 mg/kg for PCBs was collected from the eastern portion of the cooling pond. A field duplicate of that sample contained a PCB concentration of only 47 mg/kg, which is below the TSCA threshold. Based on the site characterization analytical data, the volume of material that may have exceeded 50 mg/kg is less than 210 cubic yards. At worst case, the portion of the pond sediment that exceeded 50 mg/kg may require disposal at a TSCA facility, while the remaining 84,790 cubic yards of pond sediment, impacted overburden and berm fill, and logs/wood debris should be eligible for disposal at a solid waste facility.

Cost Screening - The total present-worth cost for this alternative has been estimated at $6,940,493. Table 21 presents the cost details associated with implementing this alternative. The total cost includes the present-worth value of 30 years of annual maintenance and monitoring costs in addition to capital costs. The total cost includes the present-worth value of 30 years of annual maintenance and monitoring costs in addition to capital costs.

Screening Summary

This alternative has been retained for further evaluation because it provides a high degree of effectiveness and permanence at a relatively low cost.

6.3.8 Alternative 7: Dry Excavation with Off Site Disposal at a TSCA Landfill

The strategy for Alternative 7 involves removing the contaminated solid media at the Site and disposing of these wastes in a TSCA-permitted disposal facility, pending profiling and acceptance of the waste at the disposal facility. The sources to be disposed of include the pond sediment, impacted overburden and berm fill, and the impacted logs/wood debris. The two nearest TSCA-permitted disposal facilities with the capacity to dispose of the wastes are both located approximately 600 miles from the site (one facility in Grand View, Idaho and the other near Knoll, Utah).

Effectiveness - This alternative would effectively reduce contaminant mobility at the site by removing the contaminant sources to a secure location. Consequently, the site problems are expected to be permanently corrected. Contaminant toxicity and volume would not be reduced, but would be permanently transferred to a different physical location. Disposal at a TSCA-permitted facility establishes long-term monitoring and control programs to enhance continued effectiveness. Short-term risks of exposure to the contaminated material would occur during transport to the disposal facility. However, the PCB concentrations in the waste materials are less than the TSCA threshold of 50 mg/kg. One pond sediment sample had a concentration of 65 mg/kg; however, a field duplicate of this sample had a concentration of only 47 mg/kg.

Based on the site characterization analytical data, the volume of material that may have exceeded 50 mg/kg is less than 210 cubic yards.

Implementability - This alternative is both technically and administratively feasible. The construction steps required (excavation and loadout) are considered standard construction practices. Key project components, such as the availability of equipment, materials, and a TSCA facility with adequate capacity, are present and would allow for the timely implementation and successful execution of the proposed plan. However, as described above, the waste generally does not exceed the criteria that requires disposal at a TSCA facility.

Cost Screening - The total present-worth cost for this alternative has been estimated at $30,940,821. Table 22 presents the cost details associated with implementing this alternative. The total cost includes the present-worth value of 30 years of annual maintenance and monitoring costs in addition to capital costs.

Screening Summary

This alternative has not been retained for further evaluation due to high costs. A similar degree of relative effectiveness can be obtained by other alternatives being evaluated at reduced costs.

6.4 Alternatives Screening Summary

Table 23 summarizes the findings of the alternatives screening exercise. Costs generated and summarized in Table 23 are present-worth values which include construction costs, as well as operation/monitoring and maintenance costs, for a 30-year period. These cost estimates are order-of-magnitude estimates generated for planning purposes.

Institutional controls (Alternative 2) will not be retained for detailed analysis because it is not effective at protecting human health and the environment as a stand alone option. Dry excavation with ex situ dehalogenation (Alternative 3) and dry excavation with ex situ high temperature thermal desportion (Alternative 4) will not be retained for detailed analysis because of the extreme high costs and because the PCB concentrations are not high enough to warrant this level of treatment. Off-site disposal at a TSCA facility will not be retained for detailed analysis because of the high cost and the PCB concentrations in the waste materials generally do not exceed the requirements for disposal at a solid waste facility; however, a small portion of the waste material (approximately 210 cubic yards) may require disposal at a TSCA facility.

7.0 DETAILED ANALYSIS OF REMEDIATION ALTERNATIVES

The purpose of the detailed analysis is to provide a more in depth evaluation of the alternatives that were retained after the preliminary evaluation of remediation alternatives. Only those remediation alternatives which were retained after the preliminary evaluation in Section 6.3 are included in the detailed analysis.

A summary of the alternative screening criteria are presented in Table 24. As required by CERCLA and the NCP, remediation alternatives that were retained after the preliminary evaluation have to be evaluated individually against the following criteria:

- overall protection of human health and the environment;
- compliance with ARARs;
- long-term effectiveness and permanence;
- reduction of toxicity, mobility, or volume through treatment;
- short-term effectiveness;
- implementability; and
- cost.

Supporting agency acceptance and community acceptance are additional criteria that will be addressed after DEQ-MWCB, EPA, and the public have a chance to review the evaluations presented. The analysis criteria have been used to address the CERCLA requirements and considerations with EPA guidance (EPA, 1988), as well as additional technical and policy considerations. These analysis criteria serve as the basis for conducting the detailed analysis and subsequently selecting the preferred remediation alternative. The criteria listed above are categorized into three groups, each with distinct functions in selecting the preferred alternative. These groups include:

- Threshold Criteria - overall protection of human health and the environment and compliance with ARARs;
- Primary Balancing Criteria - long-term effectiveness and permanence; reduction of toxicity, mobility, or volume through treatment; short-term effectiveness; implementability; and cost; and
- Modifying Criteria - state and community acceptance.

Overall protection of human health and the environment and compliance with applicable or relevant and appropriate requirements are threshold criteria that must be satisfied for an alternative to be eligible for selection. Long-term effectiveness and permanence; reduction of toxicity, mobility, or volume; short-term effectiveness; implementability; and cost are the primary balancing factors used to weigh major trade-offs between alternative waste management strategies. State and community acceptance are modifying considerations that are formally considered after public comment is received on the proposed plan and the EE/CA report (Federal Register, No. 245, 51394-50509, December 1988). Each of these criteria is briefly described in the following paragraphs.

Compliance with ARARs criteria assesses how each alternative complies with applicable or relevant and appropriate standards, criteria, advisories, or other guidelines. Waivers will be identified, if necessary. The following factors will be addressed for each alternative during the detailed analysis of ARARs:

- compliance with chemical-specific ARARs;
- compliance with action-specific ARARs;
- compliance with location-specific ARARs; and
- compliance with appropriate criteria, advisories, and guidelines.

Long-term effectiveness and permanence evaluates the alternative's effectiveness in protecting human health and the environment after response objectives have been met. The following components of the criteria will be addressed for each alternative:

- magnitude of remaining risk;
- adequacy of controls; and
- reliability of controls.

The reduction of toxicity, mobility, or volume assessment evaluates anticipated performance of the specific treatment technologies. This evaluation focuses on the following specific factors for a particular remediation alternative:

- the treatment process, the remedies they will employ, and the materials they will treat;
- the amount of hazardous materials that will be destroyed or treated, including how principal threat(s) will be addressed;
- the degree of expected reduction in toxicity, mobility, or volume measured as a percentage of reduction (or order of magnitude);
- degree to which the treatment will be irreversible; and
- the type and quantity of treatment residuals that will remain following treatment.

Short-term effectiveness evaluates an alternative's effectiveness in protecting human health and the environment during the construction and implementation period until the response objectives are met. Factors that will be considered under this criteria include:

- protection of the surrounding community during remedial actions;
- protection of on-site workers during remedial actions;
- protection from environmental impacts; and
- time until removal response objectives are achieved.

Implementability evaluates the technical and administrative feasibility of alternatives and the availability of required resources. Analysis of this criterion will include the following factors and subfactors:

<u>Technical Feasibility</u>

- construction and operation;
- reliability of technology;
- ease of undertaking additional remedial action; and
- monitoring considerations.

<u>Administrative Feasibility</u>

- RCRA disposal restrictions;
- institutional controls; and
- permitting requirements.

Availability of Services and Materials

- adequate off-site treatment, storage capacity, and disposal service;
- necessary equipment and specialists and provisions to ensure any necessary additional resources;
- timing of the availability of technologies under consideration; and
- services and materials.

The cost assessment evaluates the capital and operation and maintenance (O&M) costs of each alternative. A present-worth analysis based on a 7-percent inflation rate and a maximum design life of 30 years will be used to compare alternatives. Cost screening consists of developing conservative, order-of-magnitude cost estimates based on similar sets of site-specific assumptions. Cost estimates for each alternative will consider the following factors:

Capital Costs

- construction costs;
- equipment costs;
- land and site development costs;
- disposal costs;
- engineering design;
- legal fees, license, and permit costs;
- startup and troubleshooting costs; and
- contingency allowances.

Annual Costs

- operating labor;
- maintenance materials and labor;
- auxiliary materials and energy;
- disposal residues;
- purchased services (i.e., sampling costs, laboratory fees, professional fees);
- administrative costs;
- insurance, taxes, and licensing;
- maintenance reserve and contingency funds;
- rehabilitation costs; and
- periodic site reviews.

Supporting agency acceptance will evaluate the technical and administrative issues and concerns the supporting agency may have regarding each of the alternatives. Because DEQ has taken the lead role in preparing the EE/CA, this criterion will address EPA's views on the evaluation and analysis presented here. Supporting agency acceptance will also focus on legal issues and compliance with state statutes and regulations. Community acceptance will incorporate public concerns into the analyses of the alternatives.

The final step of this process is to conduct a comparative analysis of the alternatives. The analysis will include a discussion of the alternative's relative strengths and weaknesses with respect to each of the criteria and how reasonable key uncertainties could change expectations of their relative performance.

Once completed, this evaluation will be used to select the preferred alternative(s). The selection of the preferred alternative(s) will be documented in an Action Memorandum. Public meetings to present the alternatives will be conducted and significant oral and written comments will be addressed in writing.

7.1 Alternative 1: No Action

The no action alternative means that no remediation is completed at the site to control contaminant migration or to reduce toxicity or volume. This option would require no further remedial investigation or monitoring action at the site. The no action response is generally used as a baseline against which other remediation options can be compared. This alternative has been retained for further evaluation as suggested by the NCP.

7.1.1 Overall Protection of Human Health and the Environment

The no action alternative provides no control of exposure to the contaminated materials and no reduction in risk to human health or the environment. Under this alternative, site contaminants could migrate to air, ground water, and surface water.

Protection of human health would not be achieved under the no action alternative. Prevention of direct human exposure through the pathways of concern would not be achieved. Ingestion, dermal contact, and inhalation of CoCs would not be reduced. Protection of the environment would also not be achieved under the no action alternative. Risks posed by ecological exposures would remain unchanged.

7.1.2 Compliance with ARARs

A comprehensive list of federal and state ARARs is presented in Section 4.0 and Appendix E. ARARs are divided into contaminant-specific, location-specific, and action-specific requirements. Under the no action alternative, no contaminated materials would be treated, removed, or actively managed. Leaching and releases of contaminants to ground water and surface water would not be reduced under this alternative and surface water standards could be exceeded. Allowing disposal or storage of the toxic materials, including PCB contaminated materials, in the 100-year floodplain would violate floodplain and solid waste ARARs.

7.1.3 Long-Term Effectiveness and Permanence

Toxicity, mobility, and volume of contaminants would not be reduced under the no action alternative. Also, protection of human health and the environment would not be achieved under this alternative. No control measures would be completed on the waste sources identified as causing environmental impacts at the site. The no action alternative would not address Site impacts that have been identified nor would it provide controls on contaminant migration via direct contact or leaching. The no action alternative would not address the stability of the berm or the risk of catastrophic failure of the impoundment.

7.1.4 Reduction of Toxicity, Mobility, or Volume Through Treatment

The no action alternative would provide no reduction in toxicity, mobility, or volume of the contaminated materials.

7.1.5 Short-Term Effectiveness

Short-term effectiveness is not applicable.

7.1.6 Implementability

Technical and administrative feasibility evaluation criteria do not apply to this alternative.

7.1.7 Costs

No capital or operating costs would be incurred under this alternative. Monitoring costs have been estimated at $1,000 per year for annual inspections. The total present worth cost for no action, including 30 years of annual inspections at a cost of $1,000 per year, is estimated at $12,409.

7.2 Alternative 5: Dry Excavation with On Site Disposal in a Modified RCRA Repository

The remediation strategy for Alternative 5 involves removing all identified waste sources at the cooling pond area and disposing of these wastes in a constructed repository which complies with RCRA Subtitle C regulations for hazardous waste landfill closures (Figure 39). To reduce the overall repository height and ease the construction requirements, it has been assumed that the compacted clay liners would be substituted with geosynthetic clay liners. The repository would consist of a composite, double-lined leachate collection and removal system underlying the waste in conjunction with a composite, multi-layered, lined cap overlying the waste. It is assumed that the repository base can be excavated to a depth of at least two feet without interference from bedrock. The initial repository excavation will provide cover soil for capping the repository and reduce the overall height of the repository. If bedrock is encountered in the repository excavation, then additional cover soil will need to be recovered from elsewhere on site or imported from off site.

After the repository area has been excavated and the surface prepared, a bottom liner and leachate collection system would be installed. Once the waste sources are placed in the repository, a multi-layered cap would be constructed overlying the waste, and the repository cap would be revegetated. A runon/runoff control ditch would be constructed in the area of the repository to divert surface water away from the repository cap.

The volume of impacted material is estimated at 85,000 cubic yards, or approximately 119,000 tons. The upper portion of the berm and pond sediment (above the river level) would be excavated by dry methods without dewatering. The pond sediment is expected to be wet and may need to be blended with the drier overburden and berm material to meet the landfill moisture specifications.

Excavation of the material below the river and aquifer level will require dewatering of the cooling pond area. Previous work on the Milltown Dam sediment removal project has indicated that sheet piling is difficult to drive because of the presence of large cobbles and boulders. An alternative to sheet piling is the use of water-filled coffer dams. Water-filled coffer dams combine three or more polyethylene or woven geo-textile tubes together and any locally available water supply. Two inner tubes, contained by an outer "master" tube, are pumped full of water simultaneously. Counter friction between the master and inner tubes results in a stable, non-rolling ‘wall’ of contained water, which conforms to the stream bed as the coffer dam is deployed. The filled coffer dam forms an impervious, solid wall of water that will separate the cooling pond area from the Blackfoot River. After the water-filled coffer dam is installed along the northern perimeter of the cooling pond, pumps will be used to dewater the excavation area. Water removed from the excavation area will likely require treatment prior to discharge to the Blackfoot River. Treatment will likely include settling or filtration to remove sediment and treatment with activated carbon to remove residual PCBs and hydrocarbons.

The impacted berm, pond sediment, and logs/wood debris will be placed in the repository. After the waste is removed, the former cooling pond area will be graded and contoured to return the river corridor to a more natural setting. An estimated 24,000 cubic yards of non-impacted overburden and berm material will be used to reconstruct the stream bank and floodplain in the former cooling pond area. The disturbed areas will be amended with organic compost and seeded with a mixture of native grasses, forbs, and trees to promote Site stability and aesthetics. Figure 40 shows the conceptual design of the cooling pond area after removal of the berm and pond sediment.

7.2.1 Overall Protection of Human Health and the Environment

The implementation of this alternative would provide a means of reducing or eliminating the threat of direct contact with the waste material as well as reducing the risk of airborne exposure and soil ingestion. In addition, isolating the waste would provide environmental protection by limiting the infiltration of precipitation and surface water that may leach contaminants to ground water and seepage into the Blackfoot River.

The threat of direct human exposure would essentially be eliminated by this alternative. The potential for ingestion, dermal contact, and inhalation of soil containing Site CoCs would be eliminated over the long term. Risks would be reduced to acceptable levels for recreational or residential uses. Protection of the environment would be achieved under this alternative by removing ecological exposures to the Site Cocs. Prevention of ecological exposures via exposure to water, sediment, and soil would be achieved.

7.2.2 Compliance with ARARs

Table 3 shows that contaminant-specific ARARs for PCBs are not being met in the berm fill material, pond sediment, and ground water in monitoring well M3. Removal of the cooling pond and sediment would remove the source of PCBs and should result in an improvement in ground water quality. Once the source of the PCBs is removed, it is expected that the PCB concentrations in ground water will decrease to below the contaminant-specific ARARs for PCBs. Contaminant-specific ARARS for PCBs are currently being met in surface water in the cooling pond.

Implementation of this alternative is also expected to satisfy air quality regulations because the repository cap and vegetative cover would stabilize the contaminant sources and inhibit fugitive emissions.

Location-specific ARARs are expected to be met in the implementation of this alternative. Contacts with the appropriate agencies and acquisition of required permits related to streambeds, floodplains, and archaeological/paleontological resources would be completed.

Action-specific ARARs are expected to be met including the disposal requirements of TSCA and the hydrological regulations contained in the Strip and Underground Mine Reclamation Act. Any temporary stream diversions for construction activities will require coordination with the Montana Department of Fish, Wildlife, and Parks, The U.S. Army Corps of Engineers, the Montana Department of Natural Resources and Conservation, and the Missoula County Conservation District. Revegetation requirements contained in the Surface Mining and Control Reclamation Act would be met. State of Montana air quality regulations related to dust suppression and control during construction activities will be met using water sprays where applicable, i.e. the excavation area and haul roads with heavy vehicular traffic.

Occupational Safety and Health Administration (OSHA) requirements would be met by requiring appropriate safety training for all on-site workers during the construction phase. Site activities would be conducted under the guidance of a Health and Safety Plan for the site as per OSHA 29 CFR 1910.120. Site personnel will have completed 40-hour hazardous waste operations and emergency response training and would be current on the 8-hour annual refresher training as required by OSHA.

7.2.3 Long-Term Effectiveness and Permanence

This alternative would reduce contaminant mobility at the site by removing the highest risk, solid media contaminant sources and disposing of these wastes in an engineered repository. The pond sediment, impacted overburden, impacted berm fill, and logs/wood debris would be encapsulated in an engineered repository that would effectively isolate this waste and reduce contaminant mobility. Periodic inspections and maintenance would ensure the long-term stability of the repository.

Grading and revegetation of the cooling pond area would stabilize the land surface by providing erosion protection from surface water and wind, and would reduce net infiltration through the medial by increasing the evapotranspiration process. Determining the proper grading layout for the area after removal, selecting good quality cover soil, and selecting the appropriate plant species for revegetation would enhance the long-term effectiveness of this alternative.

7.2.4 Reduction of Toxicity, Mobility, or Volume Through Treatment

Reduction of contaminant mobility is the primary objective of this alternative. The volume and toxicity of the contaminants in the waste materials would not be physically nor chemically reduced. The excavation of the waste materials from the Blackfoot River corridor would reduce the contaminant mobility by moving the waste to a secure location. The waste materials would be encapsulated in an engineered structure and physical location which is protected from erosion and water infiltration.

7.2.5 Short-Term Effectiveness

It is anticipated that construction activities related to the implementation of this alternative would be completed in one construction season. Impacts associated with construction activities would generally be less than 180 days and should not significantly impact human health nor the environment. On-site workers would be protected by following a site specific Health and Safety Plan, employing appropriate personal protective equipment and by following proper operating and safety procedures. However, short term air quality impacts to the immediate environment may occur due to the relatively large volume of waste excavation and hauling. Control of fugitive dust may require the use of water sprays. Short-term impacts to the surrounding community are expected to be minimal due to the location of the repository on the Stimson property.

7.2.6 Implementability

This alternative is both technically and administratively feasible. Waste removal and repository construction are readily implementable using conventional construction techniques. Key project components, such as the availability of equipment, materials, and construction expertise, are present and would aid in the timely implementation and successful execution of the proposed project.

7.2.7 Costs

The total present-worth cost for this alternative has been estimated at $6,043,963. Table 20 presents the cost details associated with implementing this alternative. The total cost includes the present-worth value of 30 years of annual maintenance and monitoring costs in addition to capital costs. The total cost includes the present-worth value of 30 years of annual maintenance and monitoring costs in addition to capital costs. Monitoring costs include 30 years of semi-annual ground water monitoring from eight monitoring wells for the parameters of PCBs, pH, specific conductance, and chlorinated organics as required under 40 CFR Part 761.75 (b)(6)((iii). The cost estimate assumes that a geotextile cushion and geosynthetic clay liner (GCL) are used rather than compacted clay soil in a typical RCRA repository design.

This present-worth cost does not include costs for acquisition of the repository property or opportunity costs associated with land use restrictions related to the repository. A complete cost screening for an on-site repository alternative would include opportunity costs associated with the land where repository is constructed. An opportunity cost is the cost associated with an opportunity forgone. In this case, the opportunity cost would be the value that could have been derived from a future beneficial use of the property. Potential future uses of the property are unknown at this time. Other sawmills in the northwest (e.g., sawmills along the Spokane River in Coeur d'Alene, Idaho) have been developed into high-end housing or commercial/retail properties. A repository located on the Stimson property would substantially limit future uses of that portion of the property. The conceptual repository design is 300 feet wide by 900 feet long (6.2 acres). Considering an additional 100-foot wide open-space buffer around the perimeter of the repository, the land designated for the repository is approximately 12.6 acres. These 12.6 acres would be considered ineligible for any future beneficial uses. The future value of this property would be determined at some point in the future if or when development were to occur, and cannot accurately be predicted at this point in time. However, potential opportunity costs for the repository property should be considered when comparing alternatives.

Conceptual Design and Assumptions

The repository would be constructed in the log yard area southeast of the cooling pond and would cover an area of approximately 6.2 acres (300 feet X 900 feet). An estimated 19,470 cubic yards of soil would be excavated from the repository area prior to waste placement and stockpiled for repository cover soil. The repository base would be lined with a geotextile cushion, GCL, 30-mil flexible membrane liner, gravel drainage layer, 30-mil flexible membrane liner, gravel drainage layer, geotextile filter fabric and leachate collection system.

The wastes would be placed in the repository in a sequence that provides the most benefit to the repository. A layer of fine-grained pond sediment will be placed on the repository liner to act as a cushion prior to placement of material with rocks or wood debris to protect the liner. Similarly, a layer of finer-grained material will be placed on the top of the repository to provide a cushion for the cap liner. The repository cap includes a geotextile cushion, GCL, 20-mil flexible membrane liner, geocomposite drainage layer and cover soil. A runon control ditch would be installed to divert water away from the repository.

The cooling pond area would be dewatered using a water-filled coffer dam to isolate the pond from the Blackfoot River. After dewatering, the cooling pond area will be excavated by dry methods using conventional excavation equipment. After the repository construction, waste excavation, and waste placement are complete, the excavated source area would be graded, contoured, and revegetated. An estimated 24,200 cubic yards of non-impacted overburden and berm fill will be used to reconstruct the stream bank and grade and contour the floodplain area. It is assumed that soil from the repository excavation would be stockpiled and used for cover soil on the repository. It is assumed that organic compost would be applied to the repository cover soil and the graded floodplain area to help promote the establishment of stable vegetation.

The seed beds would be prepared using conventional agricultural plowing. Seeding would likely take place during the fall of the year. The seed mixture and fertilizer would be applied simultaneously to the prepared seed beds via drill and hydroseeding application. Mulch would be applied to promote temporary protection of exposed erodible surfaces. Wheat or barley straw mulch (certified weed-free) would be applied over the excavated areas and the repository cap with a tow spreader or pneumatic spreader utilizing tucking/crimping as the anchoring mechanism.

A runon/runoff control ditch would be constructed in the area of the repository to divert runoff away from the repository cap. A woven-wire fence would be constructed around the repository to limit access.

The general construction steps for implementing Alternative 5 are as follows:

- site preparation including road improvements and clearing and grubbing;
- installation of dewatering equipment including a water-filled coffer dam and dewatering pumps, hoses and piping;
- preparation of the repository base, including vegetation, rock and debris removal, and recovery and stockpiling of cover soil;
- placement of the repository base liner and leachate collection system;

- removal of and stockpiling of non-impacted overburden and berm fill material;
- excavation and removal of impacted overburden, pond sediment, berm fill, and logs/wood debris;
- placement, grading, and compaction of waste materials in the repository;
- installation of the cap liners and drainage layer;
- placement and grading of stockpiled cover soil on the repository;
- application of organic compost on the repository;
- constructing surface water diversion ditches strategically located to control water runon in the vicinity of the repository;
- backfilling, grading, and contouring of cooling pond area with the non-impacted, stockpiled overburden and berm fill;
- grading of the river bank and floodplain area;
- application of organic compost on the graded floodplain area;
- establishing vegetation on the repository, excavated waste and impacted soil areas, borrow soil stockpile area and haul roads by seeding, fertilizing and mulching; and
- construction of a woven-wire fence around the repository.

7.3 Alternative 6: Dry Excavation with Off Site Disposal Primarily at a Solid Waste Landfill

The strategy for Alternative 6 involves removing the contaminated solid media at the Site and disposing of 84,790 cubic yards of waste in a Class II Municipal Solid Waste (MSW) Landfill and approximately 210 cubic yards of waste containing a PCB concentration of greater than 50 mg/kg in a TSCA landfill. The sources to be disposed of include the pond sediment, impacted overburden and berm fill, and the impacted logs/wood debris. The nearest disposal facility is the Allied Waste Landfill in Missoula, Montana, which is permitted for Class II solid wastes.

The volume of impacted material is estimated at 85,000 cubic yards, or approximately 119,000 tons. The upper portion of the berm and pond sediment (above the river level) would be excavated by dry methods without dewatering. The pond sediment is expected to be wet and may need to be blended with the drier overburden and berm material to meet the landfill moisture specifications.

Excavation of the material below the river and aquifer level will require dewatering of the cooling pond area. Previous work on the Milltown Dam sediment removal project has indicated that sheet piling is difficult to drive because of the presence of large cobbles and boulders. An alternative to sheet piling is the use of water-filled coffer dams. Water-filled coffer dams combine three or more polyethylene or woven geo-textile tubes together and any locally available water supply. Two inner tubes, contained by an outer "master" tube, are pumped full of water simultaneously. Counter friction between the master and inner tubes results in a stable, non-rolling ‘wall’ of contained water, which conforms to the stream bed as the coffer dam is deployed. The filled coffer dam forms an impervious, solid wall of water that will separate the cooling pond area from the Blackfoot River. After the water-filled coffer dam is installed along the northern perimeter of the river, pumps will be used to dewater the excavation area. Water removed from the excavation area will likely require treatment prior to discharge to the Blackfoot River. Treatment will likely include settling or filtration to remove sediment and treatment with activated carbon to remove residual PCBs and hydrocarbons.

The impacted berm, pond sediment, and logs/wood debris will be loaded onto haul trucks and transported to the landfill. After the waste is removed, the former cooling pond area will be graded and contoured to return the river corridor to a more natural setting. An estimated 24,000 cubic yards of non-impacted overburden and berm material will be used to reconstruct the stream bank and floodplain in the former cooling pond area. The disturbed areas will be amended with organic compost and seeded with a mixture of native grasses, forbs, and trees to promote Site stability and aesthetics. Figure 40 shows the conceptual design of the cooling pond area after removal of the berm and pond sediment.

7.3.1 Overall Protection of Human Health and the Environment

The implementation of this alternative would provide a means of reducing or eliminating the threat of direct contact with the materials, as well as reducing the risk of airborne exposure and soil ingestion. In addition, removing the wastes form the site and isolating them in a landfill would provide environmental protection by limiting the infiltration of precipitation and surface water that may leach contaminants to ground water and seepage into the Blackfoot River.

The threat of direct human exposure would essentially be eliminated by this alternative. The potential for ingestion, dermal contact, and inhalation of soil containing Site CoCs would be eliminated over the long term. Risks would be reduced to acceptable levels for recreational or residential uses. Protection of the environment would be achieved under this alternative by removing ecological exposures to the Site CoCs. Prevention of ecological exposures via exposure to water, sediment, and soil would be achieved.

7.3.2 Compliance with ARARs

Table 3 shows that contaminant-specific ARARs for PCBs are not being met in the berm fill, pond sediment, and ground water in monitoring well M3. Removal of the cooling pond and sediment would remove the source of PCBs and should result in an improvement in ground water quality. Once the source of the PCBs are removed, it is expected that the PCB concentrations in ground water will decrease to below the contaminant-specific ARARs for PCBs. Contaminant-specific ARARS for PCBs are currently being met in surface water in the cooling pond.

Implementation of this alternative is also expected to satisfy air quality regulations because the removal of the cooling pond and sediment and establishing vegetative cover would stabilize the Site and inhibit fugitive emissions.

Location-specific ARARs are expected to be met in the implementation of this alternative. Contacts with the appropriate agencies and acquisition of required permits related to streambeds, floodplains, and archaeological/paleontological resources would be completed.

Action-specific ARARs are expected to be met including the disposal requirements of TSCA and the hydrological regulations contained in the Strip and Underground Mine Reclamation Act. Any temporary stream diversions for construction activities will require coordination with the Montana Department of Fish, Wildlife, and Parks, The U.S. Army Corps of Engineers, the Montana Department of Natural Resources and Conservation, and the Missoula County Conservation District. Revegetation requirements contained in the Surface Mining and Control Reclamation Act would be met. State of Montana air quality regulations related to dust suppression and control during construction activities will be met using water sprays where applicable, i.e. the excavation area and haul roads with heavy vehicular traffic.

Occupational Safety and Health Administration (OSHA) requirements would be met by requiring appropriate safety training for all on-site workers during the construction phase. Site activities would be conducted under the guidance of a Health and Safety Plan for the site as per OSHA 29 CFR 1910.120. Site personnel will have completed 40-hour hazardous waste operations and emergency response training and would be current on the 8-hour annual refresher training as required by OSHA.

7.3.3 Long-Term Effectiveness and Permanence

This alternative would reduce contaminant mobility at the site by removing the highest risk, solid media contaminant sources and disposing of these wastes in a permitted landfill. The pond sediment, impacted overburden, impacted berm fill, and logs/wood debris would be encapsulated in a permitted landfill, which would effectively isolate this waste and reduce contaminant mobility. This alternative achieves long-term risk reduction by transporting the contaminated materials to a facility that specializes in the storage and disposal of non-hazardous wastes, thus ensuring the long-term permanence of the remedy.

Grading and revegetation of the cooling pond area would stabilize the land surface by providing erosion protection from surface water and wind, and would reduce net infiltration through the medial by increasing the evapotranspiration process. Determining the proper grading layout for the area after removal, selecting good quality cover soil, and selecting the appropriate plant species for revegetation would enhance the long-term effectiveness of this alternative.

7.3.4 Reduction of Toxicity, Mobility, or Volume Through Treatment

Reduction of contaminant mobility is the primary objective of this alternative. The volume and toxicity of the contaminants in the waste materials would not be physically nor chemically reduced. The excavation of the waste materials from the Blackfoot River corridor would reduce the contaminant mobility by moving the waste to a secure location. The waste materials would be encapsulated in an engineered landfill cell, which is protected from erosion and water infiltration.

7.3.5 Short-Term Effectiveness

It is anticipated that construction activities related to the implementation of this alternative would be completed in one construction season. Impacts associated with construction activities would generally be less than 180 days and should not significantly impact human health nor the environment. On-site workers would be protected by following a site specific Health and Safety

Plan, employing appropriate personal protective equipment and by following proper operating and safety procedures. However, short term air quality impacts to the immediate environment may occur due to the relatively large volume of waste excavation and hauling. Control of fugitive dust may require the use of water sprays. Impacts to the surrounding community are expected to be minimal due to the location of the project site. The only foreseen short-term impact to the surrounding community would involve increased vehicle traffic, particularly haul truck traffic, with associated safety hazards and potential dust generation. A traffic control plan, including warning signs and possibly flaggers, will be required while transporting these wastes.

7.3.6 Implementability

This alternative is both technically and administratively feasible. Waste removal, transportation and disposal, and establishing vegetation are readily implementable using conventional construction techniques. Key project components, such as the availability of equipment, construction expertise, and sufficient landfill space, are present and would aid in the timely implementation and successful execution of the proposed project.

7.3.7 Costs

The total present-worth cost for this alternative has been estimated at $6,940,493. Table 21 presents the cost details associated with implementing this alternative. The total cost includes the present-worth value of 30 years of annual maintenance and monitoring costs in addition to capital costs. The total cost includes the present-worth value of 30 years of annual maintenance and monitoring costs in addition to capital costs.

<u>Conceptual Design and Assumptions</u>

The cooling pond area would be dewatered using a water-filled coffer dam to isolate the pond from the Blackfoot River. After dewatering, the cooling pond area will be excavated by dry methods using conventional excavation equipment. After the waste excavation is complete, the excavated source area would be graded, contoured, and revegetated. An estimated 24,200 cubic yards of non-impacted overburden and berm fill will be used to reconstruct the stream bank and grade and contour the floodplain area. It is assumed that organic compost would be applied to the repository graded floodplain area to help promote the establishment of stable vegetation.

The seed beds would be prepared using conventional agricultural plowing. Seeding would likely take place during the fall of the year. The seed mixture and fertilizer would be applied simultaneously to the prepared seed beds via drill and hydroseeding application. Mulch would be applied to promote temporary protection of exposed erodible surfaces. Wheat or barley straw mulch (certified weed-free) would be applied over the excavated areas with a tow spreader or pneumatic spreader utilizing tucking/crimping as the anchoring mechanism.

The general construction steps for implementing Alternative 6 are as follows:

- site preparation including road improvements and clearing and grubbing;
- installation of dewatering equipment including a water-filled coffer dam and dewatering pumps, hoses and piping;

- removal of and stockpiling of non-impacted overburden and berm fill material;
- excavation and removal of impacted overburden, pond sediment, berm fill, and logs/wood debris;
- loading and hauling waste material to the landfill;
- backfilling, grading, and contouring of cooling pond area with the non-impacted, stockpiled overburden and berm fill;
- grading of the river bank and floodplain area;
- application of organic compost on the graded floodplain area; and
- establishing vegetation on the repository, excavated waste and impacted soil areas, borrow soil stockpile area and haul roads by seeding, fertilizing and mulching.

8.0 COMPARATIVE ANALYSIS OF REMEDIATION ALTERNATIVES

This section provides a comparison of the remediation alternatives retained for the Stimson Lumber Company Cooling Pond site. The comparison focuses mainly on the following criteria: 1) the relative protectiveness of human health and the environment provided by the alternatives; 2) the long-term effectiveness and permanence provided by the alternatives; and 3) the estimated attainment of ARARs for each alternative. Qualitative comparisons are used to contrast the two threshold criteria of "overall protection of human health and the environment" and "compliance with ARARs" for each alternative. The primary balancing criteria are also compared, although, the evaluation of each of these criteria is very similar due to the technical similarities in the alternatives themselves, with the exception of costs. Table 25 presents a summary of the alternatives with respect to the first eight evaluation criteria.

Alternative 1 - No Action is not considered any further since this alternative would not address any of the environmental concerns raised for the site and would not meet contaminant-specific ARARs.

Of the alternatives retained for the Site, Alternatives 5 and 6 provide a similar degree of overall protection of human health and the environment since both alternatives provide for complete removal of the contaminated materials from the Blackfoot River corridor. The main difference between Alternatives 5 and 6 is the disposal method. Alternative 5 provides for disposal of the contaminated materials in an on site repository, while Alternative 6 provides for disposal in a solid waste landfill. The two alternatives are expected to provide a similar degree of risk reduction since both alternatives isolate the waste from human and environmental receptors. Alternative 5 would require ongoing operation and maintenance to ensure the stability and integrity of the repository. Alternative 6 would transfer the operation and maintenance responsibility to the landfill facility. Since the landfill facility specializes in the storage and disposal of non-hazardous wastes, this should enhance the long-term permanence of the alternative.

Alternatives 5 and 6 are expected to achieve compliance with action-specific and location-specific ARARs. Chemical-specific ARARs for PCBs in soil and ground water are not currently being met; however, removal of the waste sources may result in long-term improvements in ground water quality. When comparing the exposure pathways of direct contact, surface water and air, both alternatives provide similar long-term reduction for the contaminants at the site.

Neither alternative reduces the toxicity or volume of the contaminants of concern. The objective of the alternatives is to sever the exposure pathway and to limit the mobility of the contaminants. Limiting contaminant mobility will achieve protection of human health and the environment and will meet applicable ARARs identified for the site.

The short-term effectiveness is expected to be, for the most part, similar to each of the action alternatives. Alternative 6 has a slightly greater short term risk to the community because of the off-site traffic from haul trucks. The alternatives are all technically similar and the construction steps required to implement them are expected to be accomplished in one field construction season.

On-site workers will be required to have hazardous materials handling training and will be subject to a site-specific Health and Safety Plan for their protection. Installation of the water-filled coffer dam in the Blackfoot River adjacent to the cooling pond berm may have some short term impact to the environment, although efforts will be made to minimize the risk by using best management practices. Because each of the alternatives will involve excavation and haulage of significant volumes of contaminated soil, pond sediment, and debris, localized air quality impacts may occur from fugitive dust emissions. Water sprays will be used to control dust emissions and to minimize dust exposure, as needed.

For implementability, Alternative 6 would be the easiest alternative to implement because the construction requirements are lesser for landfill disposal than for construction of a repository. Alternative 5 would be the most technically difficult to implement because of the increased construction quality control for the repository liner construction, liner seams, and construction of the leachate collection system; however, these are commonly used construction techniques that are readily implementable. The Implementability of Alternative 5 is contingent upon the availability of on-site property for use as a repository site.

Because of the health and safety requirements associated with the waste sources, only properly trained and experienced contractors/crews should perform the specified work. Inexperienced contractors and crews would likely prolong the construction phase and may result in increased costs and compromised safety and performance.

Tables 23 and 25 indicate the estimated total costs associated with each alternative. The no action alternative is not considered feasible because it would not address the identified risks to human health and the environment at the site. Of the action alternatives considered for the site, estimated costs for Alternatives 5 and 6 are $6,043,963 and $6,940,493, respectively. The cost for acquiring the repository site and/or opportunity costs associated with land use restrictions associated with the repository are not included in the costs for Alternative 5. To provide a fair cost comparison between Alternatives 5 and Alternative 6, the opportunity costs associated with limitations on future beneficial uses of the repository property must be considered. Potential future development could included high-end housing or commercial/retail uses as has happened at other sawmill properties in the northwest. An opportunity cost has not been estimated for the 12.6 acres associated with the repository.

9.0 PREFERRED ALTERNATIVE

The waste sources associated with the Stimson Lumber Company Cooling Pond that are contributing to environmental impacts are PCB- and hydrocarbon- impacted pond sediment, overburden soil, berm fill, and log/wood debris. The greatest risk to human health and the environment from waste sources associated with the cooling pond are the exposure via direct contact, surface water, ground water and air exposure pathways. Based on the site characterization data, the contaminants of concern are PCBs, C11-C22 range aromatic hydrocarbons, C19-C36 range aliphatic hydrocarbons, and manganese.

Based on the conclusions of the detailed analysis and comparative analysis of alternatives, Alternative 6: Dry Excavation with Off Site Disposal Primarily at a Solid Waste Landfill is proposed as the preferred alternative for remediation of the Site. This alternative is considered the most appropriate and cost-effective means to reduce risk to human health and the environment to an acceptable level. In summary, the strategy for Alternative 6 involves removing the contaminated solid media at the Site and disposing of 84,790 cubic yards of wastes in a Class II Municipal Solid Waste (MSW) Landfill and approximately 210 cubic yards of wastes containing a PCB concentration of greater than 50 mg/kg in a TSCA landfill. The sources to be disposed of include the pond sediment, impacted overburden and berm fill, and the impacted logs/wood debris. The nearest disposal facility is the Allied Waste Landfill in Missoula, Montana, which is permitted for Class II solid wastes.

The volume of impacted material is estimated at 85,000 cubic yards, or approximately 119,000 tons. The pond sediment is expected to be wet and may need to be blended with the drier overburden and berm material to meet the landfill moisture specifications.

Excavation of the material below the river and aquifer level will require dewatering of the cooling pond area. Previous work on the Milltown Dam sediment removal project has indicated that sheet piling is difficult to drive because of the presence of large cobbles and boulders. An alternative to sheet piling is the use of water-filled coffer dams. The filled coffer dam forms an impervious, solid wall of water that will separate the cooling pond area from the Blackfoot River. After the water-filled coffer dam is installed along the northern perimeter of the river, pumps will be used to dewater the excavation area. Water removed from the excavation area will likely require treatment prior to discharge to the Blackfoot River. Treatment will likely include settling or filtration to remove sediment and treatment with activated carbon to remove residual PCBs and hydrocarbons.

The impacted berm, pond sediment, and logs/wood debris will be loaded onto haul trucks and transported to the landfill. After the waste is removed, the former cooling pond area will be graded and contoured to return the river corridor to a more natural setting. An estimated 24,000 cubic yards of non-impacted overburden and berm material will be used to reconstruct the stream bank and floodplain in the former cooling pond area. The disturbed areas will be amended with organic compost and seeded with a mixture of native grasses, forbs, and trees to promote site stability and aesthetics.

10.0 REFERENCES

Bouwer, H. and R. C. Rice, 1976, A slug test method for determining hydraulic conductivity of unconfined aquifers with completely or partially penetrating wells., Water Resources Research, volume 12, number 3, pp 423-428.

DEQ, 2007, Montana Tier 1 Risk Based Corrective Action Guidance for Petroleum Releases

DEQ, 2006, Circular DEQ-7, Montana Numeric Water Quality Standards, January, 2002.

Federal Remediation Technologies Roundtable (FRTR), 2007, Remediation Technologies Screening Matrix and Reference Guide website, http://www.frtr.gov/matrix2/top_page.html.

Lewis, Reed S., 1998, Geologic Map of the Butte 1° X 2° Quadrangle, Southwest Montana, Montana Bureau of Mines and Geology Open File Report MBMG 363, 1998.

National Oceanic and Atmospheric Administration, 2007, Fast Climate Facts from the National Weather Service Office in Missoula, Montana.

Olympus Technical Services, Inc., 2007, Geotechnical Characterization Report, Stimson Lumber Company Cooling Pond and Berm, prepared for Montana Department of Environmental Quality, April 2007.

Olympus Technical Services, Inc., 2006a, Sampling and Analytical Plan Cooling Pond and Berm Characterization, The Stimson Lumber Company, Missoula, Montana, prepared for Montana Department of Environmental Quality, October 18, 2006.

Olympus Technical Services, Inc., 2006b. Site Characterization Report, Stimson Lumber Company Cooling Pond, Missoula County, Montana, prepared for Montana Department of Environmental Quality, May 31, 2006.

Olympus, 2006c. Sampling and Analytical Plan for Sediment Characterization at the Stimson Lumber Cooling Pond, Missoula County, Montana, prepared for Montana Department of Environmental Quality, March 27, 2006.

PBS&J, 2007, Stimson Fire Pond Lagoon Additional Corrective Actions and Groundwater Monitoring Report, March 6, 2007.

U.S. Environmental Protection Agency, 1988. Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA (Interim Final), U.S. Environmental Protection Agency, Office of Emergency and Remedial Response, Washington, D.C. EPA/540/G-89/004.

U.S. Environmental Protection Agency, 1990, National Oil and Hazardous Substance Pollution Contingency Plan (NCP); Final Rule (40CFR 300). Federal Register 55(46): 8666-8865, March 8, 1990.

U.S. Environmental Protection Agency, 2004, 2004, EPA Region IX Risk-Based Concentration Table.

U.S. Environmental Protection Agency, 2006, Drinking Water Standards and Health Advisories, August 2006.

U.S. Geological Survey, 2000, MODFLOW-2000, Version 1.17.02, February 14, 2007.